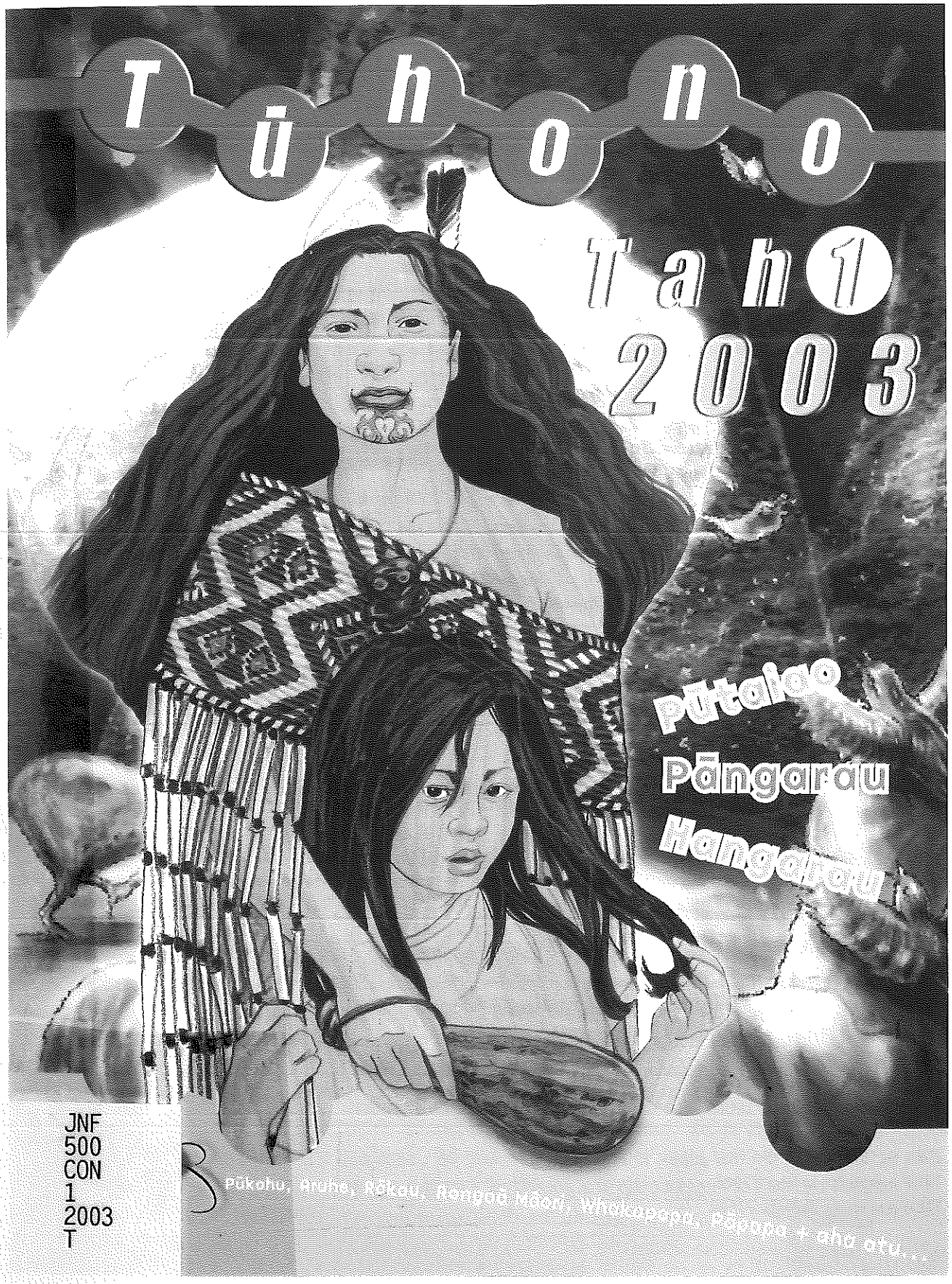
TE TĀHUHU O TE MĀTAURANGA
Ministry of Education

Ngā Kōrero mā te Pouako



He Kupu Whakataki

He huinga pukapuka a Tūhono i whakatakotoria hei whakaatu i te wāhi ki te pāngarau, te pūtaiao, me te hangarau i roto i ngā kaupapa kawea ai e ngā ākonga i ia rā. Ka noho mai he kōrero paki, he kōrero pono anō hoki hei tūāpapa, ā, ko te tikanga, mai i reira ka toro haere ngā ākonga mahi takitahi, ā-ropū, ā-akomanga rānei i te roanga atu o ngā kōrero. Mā ngā ngohe ka pārekareka ki ngā ākonga te pūtaiao, te pāngarau, me te hangarau. Kua hora mai a Tūhono Tahi nei hei whāwhātanga mā ngā tamariki kei ngā taumata 2 – 4 o te Marautanga o Aotearoa.

Te Whakamahi i Tēnei Huinga Pukapuka

Ehara i te mea kotahi anake te tikanga whakamahi i tēnei pukapuka i roto i ngā akoranga pāngarau, pūtaiao, hangarau. Tērā pea ka noho ngā kōrero o roto hei para i te huarahi ki tētahi kaupapa, hei whakamōhiotanga whānui, hei tāhuhu rānei mō tētahi akoranga.

He tautoko tonu tā te pukapuka nei i ngā ngohe me ngā rapanga o te pukapuka ki ngā ākonga. Tērā pea ka hiahia koe kia whakawhiti whakaaro tahi te akomanga i te tuatahi, kātahi ka pānui ngā ākonga i te kōrero e hāngai ana. Mō muri mahia ai tētahi ngohe, whakautua ai rānei ētahi pātai. Tērā rānei ka mahia tētahi ngohe tīmatanga, ka whiriwhiri tahi rānei te akomanga kia puta ai he rārangi pātai. Ko te hua o tēnei, ka āta mōhio ngā ākonga ki ngā āhuatanga whāiti hei kimi mā rātou ina tahuri rātou ki te pānui i te kōrero.

Arā ētahi mahi ka whai kia auaha tonu te reo pāngarau, pūtaiao, hangarau rānei. Ka noho ēnei hei whakahauhau i ngā ākonga kia tuku i ō rātou hinengaro kia rere.

Ko tā ētahi kōrero, he whakaatu i ngā kōrero pono e pā ana ki tetahi kaupapa. Tērā ka whakamahia ēnei hei tāhuhu mō tētahi rangahautanga, ka taea rānei te kawe ngātahi ki ētahi kaupapa tūhura e whakahaeretia ana e te akomanga.

Ngā Whāinga Paetae

Kua tohua ngā whāinga paetae mai i ngā whenu o te pāngarau me te pūtaiao e hāngai ana ki ia wāhanga. Kua tohua anō hoki ngā tukanga pāngarau, ngā pūkenga pūtaiao, me ngā waiaro, i ngā wāhi e tika ana. Heoi anō, ko te tukanga, ngā pūkenga, ngā waiaro rānei ka āta tirohia, kei te āhua tonu o te huarahi e hiahia ana koe ki te whai atu hei kawe i ngā mahi. Kua tohua ētahi wāhi hangarau, engari kāore i tohua he whāinga paetae mō te hangarau.

Ngā Taumata Pānui

Ko ngā kōrero i tēnei pukapuka, mā ngā ākonga kei te 9 – 13.5 tau tō rātou mātau ki te pānui. I pēnei ai i te mea, e ai ki ngā whakamātautau pānui kua roa e whāia ana, ko ngā kōrero whai kupu hangarau, e hāngai kē ana ki ngā taumata o runga ake, nā te kore e kaha whakamahia o ētahi o ngā kupu tikanga whāiti o roto. Oti anō, ka pai tonu ēnei kōrero mā ngā ākonga tamariki ake, ki te pānuitia tahitia e te ākonga me te pouako, māu tonu e whakatau, i runga i te āhua o āu ākonga me ngā mea kua whāwhā kē rātou, mēnā e tika ana kia mahia tahitia, kia ārahina rānei te pānui, me waiho rānei mā te ākonga me tōna kotahi e pānui. Kei te āhua tonu pea o te kōrero, o te tauhou rānei o ngā kupu. He mea whakamārama te pānui tahi me te pānui motuhake i te pukapuka *The Learner as a Reader*, Te Tāhuhu o te Mātauranga (Te Pou Taki Kōrero, Te Whanganui-a-Tara, 1996).

Ngā Mahi kia Mahia i te Kāinga

Ka taea te tuku ngā pukapuka kia pānuitia e ngā ākonga i te kāinga, hei wāhanga tonu o ngā akoranga pūtaiao, pāngarau, hangarau, pānui rānei. Ka pārekareka ki a rātou te whakamātau i ētahi o ngā ngohe i reira. Tērā rānei ka taea e koe te hanga ētahi atu ngohe, te whakarite rānei i ngā mea e kōrerotia ana i konei hei mahi mā ngā ākonga i te kāinga. Mā te tuku pukapuka atu ki reira, ka kite ngā mātua i te hāngai o te pāngarau me te hangarau ki ngā mahi o ia rā, ka kite anō hoki he pārekareka tonu ēnei āhuatanga.

Ngā Kaupapa Whānui o *Tūhono Tahi 2003*

1. Ngā āhuatanga o te aruhe me ētahi atu momo tipu pēnei i te pūkohu.
2. Te whakaputa uri i te ao tipu, e hāngai ana ki te hokohokonga o te uritanga paratau, paratau kore rānei kei te aruhe me te pūkohu.
3. Rongoā (hauora tikanga Māori, ngā rapunga kōrero me ngā tikanga whakahaere), e hāngai ana ki te kōhikatanga o te matū hā, hinu hā i te kawakawa me ētahi atu momo tipu e kitea noatia ana i Aotearoa nei.
4. Ko ngā tikanga pangarau hei whakatau i te heipūtanga ki ngā kēmu tūpono.
5. Ko te whakamahi i ngā pūkenga torotoro ngāwari nei me ngā tikanga pangarau, whārite, taupāpātanga, kia kitea ai i te teiteitanga o ngā taonga tāroaroa, tērā pea he uaua ki te ine.

He whakaaro ki ngā Māori me ērā o Te Moana-nui-a-Kiwa

Arā pea he kaupapa pai hei rangahau mā ngā ākonga Māori me ngā ākonga i ahu mai i Te Moana-nui-a-Kiwa. Ko te rangahau i ngā mahi rongoā i ō rātou ake ahurea tūturu, moutere tūturu hoki mā te patapatai i ō rātou ake kaumātua, mā te rangahau kōrero i te whare pukapuka, i te ipurangi rānei. Ka pai anō pea kia tūhura rātou i ngā tikanga tuku iho mō te kōhikatanga matū hā, hinu hā ka whakahaeretia e te māngai rongoā.

Ka rangahau hoki ngā ākonga, ko wai te hunga o mua i pupuri i tēnei mātauranga, ā, ka pēhea i tukuna ihotia ai ki tēnā whakatipuranga ki tēnā whakatipuranga. Ka pai anō pea kia rangahaua i ngā nekeneke e pā ana ki tēnei mātauranga i te ao hurihuri nei.

Ngā Ihirangi me ngā Hono ki te Marautanga

Ngā Ihirangi	Ngā Hono ki te Marautanga	Whārangi Pukapuka Ākonga	Whārangi Pukapuka Pouako
Hine Kawakawa, Te kakara a Māhina-ā-rangi	Ngā Rawa me ngā Pūhanga Manawa; Te Hangarau Koiora; Te Whakanao me te Hātepe; Whakairoiro me te Hoahoa; ō Kawekawe; ō Mataora	2	3
Te Ao Aruhe Hine-rau-whārangi	ō Mataora	8 18	4
Whakatupua ā koutou ake Aruhe	ō Mataora	14	5
Rata me tōna Waka, He Pēhea te Teitei o Tēnā Rākau	Te Āhuahanga; Te Inenga; Te Taurangi	21	6
He Pāpapa	Tatauranga	28	7

"Hine Kawakawa"

Ētahi Whāinga Paetae e Hāngai ana

Ngā Wāhi Hangarau
Te Hangarau Whakanao, Hātepe
Te Hangarau Matū
Te Tā, Te Whakairoiro
Pūtaiao

Ao Rawa

- 3.2: Te tūhura me te whakamārama ka pēhea e hāngai ana ngā matū āhuatanga ōkiko o ngā matū ki te whakamahi o aua matū.
- 3.3: Te tūhura me te pūrongo i ngā rerekētanga taupua, āhua tūturu rānei, e whai pānga ana ki ngā taunga matū.
- 4.2: Te tūhura me te whakamārama i te whai pānga o ngā matū e mōhio whānuitia ana, ki ngā matū ōkiko, māmā hoki.
- 4.3: Te tūhura me te whakamārama i ngā huarahi whakanao ai i ngā rerekētanga tūturu, taupua rānei, o ngā matū e mōhio whānuitia ana.

Ō Mataora

- 3.2: Te tūhura i ngā tino āhuatanga o ngā rauropi, me te whakamārama e pēhea ana aua āhuatanga e tiaki i aua rauropi.

Te Whakawhanake i ngā Whakaaro

Ko te tikanga, mā te pānui tahi i "Hine Kawakawa", "Hine-rau-whārangi", me "Pāpapa" ka mārama ake ō ākonga ki ngā whakaaro mātāmua e whai ake nei:

- Ētahi hononga ki ētahi whakapapa e pā ana ki te ngahere
- Ētahi tikanga e pā ana ki te rongoā Māori

Mai rā anō i whakamahia e te Māori ētahi momo tupu taketake hei rongoā. E mōhiotia whānuitia ana tēnei kaupapa, ko te Rongoā Māori. He maha ngā āhuatanga o te rongoā Māori e whakamahia tonutia i ēnei rā, e ētahi whānau. Ko te nuinga o ēnei e noho tonu ana i ō rātou wā kāinga. He ngākaunui te Māori ki a Papatūānuku mā ngā hononga o tōna whakapapa. E ai ki te whakaaro o te Māori, kōtahi te whānau o ngā mea katoa o te ao, e heke iho mai ana i te orokohanga. He hononga whakapapa tō ngā mea katoa, arā, ko te mauri te pūtake (te mauri e noho ana i roto i ngā mea katoa, e hono ana i te ao katoa). E ai ki ngā kōrero, ko Tāne Māhuta te atua o te ngahere, ka pūtake katoa mai ngā mea katoa o te ngahere i a ia. Nō muri i te tokonga o Rangi ki runga ko Papa ki raro, e hia kē miriona tau ki muri, nā, ka haere a Tāne ki te rapu wāhine māna.

Anei ētahi whakapapa.

Tāne ∓ Apunga
Kawakawa

Tāne ∓ Hine Tītama
Hine-rau-whārangi

Tāne ∓ Punga
Tū te wanawana
Ngarara
(ko ngā mea ngōki)

Tāne ∓ Rerenoa
Rata
(me ngā akaaka pikipiki)

Tāne ∓ Mumuwhango
Tōtara

Tāne ∓ Para-uri
Weka, a haere-awaawa

Ko ā rātou uri, ko ngā tupu maha me ngā momo aitanga-ā-pepeke o Aotearoa. Ka whakaarohia e ētahi iwi, he tūākana aua uri. Otirā, he rerekē te whakamārama a tētahi iwi i tētahi mō te āhuatanga ki ngā whakapapa ka kitea i konei. Mā te kaha uiui i ngā kaumātua, kuia rānei, e ngā ākonga, ka kitea rātou i te hononga tūturu ki a rātou anō, nā te mea nō rātou tūturu anō ngā whakapapa e hāngai ana ki tēnā iwi ki tēnā iwi.

Ko ngā pūkenga whakarite rongoā, whakaora tāngata i te rongoā, he mea tuku iho mai i tētahi whakatipuranga ki tētahi, i roto i ngā tino whānau e kawe ana i te ora ā-tinana, ora ā-wairua hoki o ō rātou whānau, hapū, iwi hoki. He mea whakarite ngā rongoā mai i te tupu kotahi, maha rānei. He mea motuhake te whakarite rongoā i ētahi atu mahi, arā te mahi kai, ngā taputapu kai rānei.

I mua i te taenga mai o te Pākehā, he mea whakaora te rongoā Māori i ngā mate huhua, pērā i te ngerengere me te mate kohi. Ko ngā whakaora, arā ngā mea inu, i whakamahia mā ngā mate whakahā, arā te mate arahau, te huangō, te maremare; me ngā mate o te ara tōnga mimi, ngā taumahatanga o te īkura, o te whakawhānau pēpi rānei. Ko ngā whakaora ka pania ki te kiri, he mea whakaora i ngā mate o te kiri, arā ko ngā wera, ngā whēwhē, te pāpaka, te ngerengere, te kiritaratara, te tona, te maringi mai o te toto, me te motu i te tinana.

Kua whakawhitiwhiti kōrero mō ētahi tau e te *Manatū Hauora* me ngā tohunga, ngā ratonga hauora Māori, me ngā iwi, e pā ana ki te kaupapa rongoā Māōri me ngā ratonga mō te nuinga o ngā tāngata o Aotearoa. Kei te tautoko te hunga pūtaiao i te whakaaro he painga tō ngā rongoā Māori, arā, kua tātaria e rātou.
I roto i ngā tau 2001, 2002 hoki, i whakahaere te *Foundation for Research (FRST)* i Te Kete a Tini Rauhanga, arā he rōpū rangahau e torotoro i te rongoā Māori e whakamahia ana e Tūhoe. Ko Tākuta Meto Leach o Te Whare Wānanga o Waikato te kaiārahi o tēnei rangahau. Ka mahi tahi a Tākuta Leach, tana rōpū rangahau, me te tohunga rongoā whai mana o Tūhoe ko Hōhepa Kereopa, kia tuhia, te tīpako, te whakarite me te whakamahi o ngā tupu rongoā o Tūhoe, me te tāutu i ngā pūhui whakakaha e whakamau ana i ngā matū whakaora.

Ngā Matū Whakaora o te Kawakawa (Macropiper excelsum)

Ehara i te mea ko ngā mōhiohio e whai ake nei he āhuatanga hei whakaora te tangata i a ia anō, arā kāore anō kia hōhonu tonu te tirotiro o te hunga pūtaiao ki ēnei āhuatanga, arā kāore anō kia tino whakaaetia. He whanaunga ētahi o ngā tupu o Te Moana-nui-a-Kiwa ki te kawakawa – ko te Kava tētahi. E tupu huhua ana te kawakawa i ngā take o ngā hiwi i ngā rohe maha mai i Te Taitokerau ki Waitaha. E mōhiotia ana te kawakawa mai i te āhua o ngā rau, arā, he rite ki te manawa te āhua, engari he tapatahi; he maha hoki ngā kōhao i ngā rau nā te timotimo a te ngārara.
He pai te inu wai kawakawa ki te tiaki i ngā tākihi, me te whakamāmā ake i ngā mate o te puku. Mēnā ka uru te rongoā mā te kiri, he mea whakaora i te haehae, i ngā motu o te tinana, i ngā whēwhē, me te wero o te ongaonga. He mea pai hoki mō te mate kaikōiwi me ētahi atu mamaetanga, arā, ko te niho tunga. E ai ki ngā kōrero he mea atiati waeroa te kawakawa mēnā ka werahia ki te ahi.

Te Whakawhanake i ngā Whakaaro

I muri i tā te ākonga pānui i te kōrero "Hine Kawakawa", he tika te kōkiri tonu i te kaupapa tupu kakara, mā te whakawhitiwhiti i te whai pānga o ngā tupu kakara ki ngā ariā me te wairua o te tangata. Hei tīmatatanga kōrero, he pai mēnā ka tīmata i te whānuitanga o te kōrero mā te pātai ki te ākonga ko ēhea ngā kakara tino tau ki a rātou, ko ēhea rānei ngā mea kāore i te tino pai ki a rātou. Hei tauira: Whakaarohia ngā kakara e pai ana ki te tangata, me ngā haunga o ngā mea piro. Ka pai mēnā ka whiriwhirihia e te ākonga ka pēhea te aro a te rauropi ki ngā kakara pai, te wehi rānei i ngā haunga piro, e tiaki ana i taua rauropi, e tiaki ana rānei i te rauropi e whakaputa ana i te haunga? Hei tauira: Ko te pūtanetane a te tangata ki te haunga o te kaipiro he mea tiaki; ka kore e kainga aua piro e te tangata. He rite te rongo ki ngā para a te tinana – ka kore te tangata e haere ki ngā wāhi pērā, ā, ka kore e hopu i ngā momo mate ka taea te hopu i ngā wāhi pērā. Māi i ēnei momo rongonga ki ngā kakara, ka whai huarahi ki te arotahi ki ngā haunga ka puta i te tupu.

He aha e puta ai te Hinu Kakara i ngā Tupu

Ko te tino take ka puta te kakara i te tupu ko te putanga i ngā hinu hā – he matū tino kakara i roto i ētahi putiputi,

pua, tātā, rau, pakiaka rānei. I ngā rā o mua, i whakaarohia kei roto i aua hinu te hā o te tupu, nā reira i puta ai te ingoa. Mai rā anō, he mea whakaora ēnei hinu hā nā te whānuitanga o ngā hua whakaora i te tangata. I te ao rauropi, ko te tino kaupapa ko te whakarata kararehe, atiati kararehe rānei. He tauira tēnei: Ko te kakara o ngā putiputi ka whakarata i ngā manu me ngā ngārara rui hae ki aua putiputi. He tohu te kakara kua māoa ngā hua o te tupu hei kai, hei kohikohi rānei; he mea whakamārara tēnei i ngā kākano. Ko ētahi haunga kaha, he mea whakapāhuna i ngā kararehe taka, mēnā ka puta i ngā rau. E pērā ana mō ngā tupu mānuka, purūkamu rānei. Kei ētahi hinu hā he matū ārai kōpura whetū, ārai huaketo hoki. Mai rā anō i whakaritea whakapiripiri arai huakita, mai i ngā rau kawakawa, hei whakaora whēwhē, me ētahi atu mate o te kiri (Tirohia te wāhanga Rongoā Māori i roto i tēnei tuhinga mō ētahi mōhiohio anō mō te rongoā Māori). I ētahi wā he para noa iho ngā hinu hā.
He pai mēnā ka whakahaerehia tētahi mahere whakaaro hei whakarārangi i ngā momo kararehe e aro ana ki ngā momo kakara tupu. Hei tauira: Ka tino rata te ngeru ki te taru whakarata ngeru, he mea whakangā, whakamoe hoki i a rātou. Ka mōhio hoki ngā ākonga tokomaha ki ngā painga o ngā kakara whakaora.

He aha te mahi a ngā Hinu Hā

Ka uru ngā matū whakakaha o ngā hinu hā ki te tinana mā ngā raina o te ara whakahā, mā ngā kōputaputa o te kiri rānei, mēnā ka mirimirihia ki te kiri, ka pania i roto i te kirīmi, hinu, rongoā pani rānei. Ka uru tōtika ngā matū ki roto i te toto, ka tere te nuku haere i roto i te tinana, ka whārite hoki i te ora o ngā whēkau. Ka tere hoki te pā o ngā matū kakara ki te roro. I te mutunga ake, ka puta atu ngā matū i te tinana mā te werawera, mā te mimi, mā te hā rānei.

Ngā Tūpatotanga

I te mea he tino kaha te āhua o ngā hinu hā, me tūpato mēnā ka whakaritea, ka whakamātauria rānei i roto i te kura. Kia kaua e inu, kia kaua e kai rānei. Kāore e pai ētahi hinu hā kaha mā te pēpi, mā te wahine hapū rānei. He pai noa iho ngā tupu e kōrerotia ake nei i roto i ēnei tuhinga i te mea he iti noa iho ngā matū whakakaha i te kōhikatanga.

Te Kōhika Hinu Hā hei Hoko

Ko te tikanga whakarite hinu hā i tuhia nei i roto i tēnei tuhinga he mea tango i te hā o ngā putiputi kawakawa mā te whaonga ki rō waiwera. Me tere whakamahi i te hinu hā kua whakaritea pērātia i te mea ā te wā ka piro. Ko ngā kōhikatanga kakara putiputi o ngā umanga he kōhikatanga ranu "horomata" nā te māmā tonu o ngā hinu – kāore e pai kia koropupū. Ka kōhikatia ēnei mā te whakamahi i ngā whakarewa tere whakaeto, pērā i te *hexane*, kia whakarewatia ngā hinu hā i roto i te kōhikatanga. Ka waihotia ēnei matū whakarewa kia whakaetotia i muri atu. Ko te iheutanga hauwai te āhua-ā-mahi kōhika o ngā umanga mō te kōhika hinu hā mai i ngā rau. Mō tēnei āhuatanga, ka hono kōhua pēhanga ki ētahi whakatōtā. Ka puta te hauwai, ka wera haere te matū i raro i te pēha i roto i te hauwai tino wera. Ka whakarewatia ngā hinu hā o ngā tupu, arā ka kawea e te hauwai, ka uru ki te ngongo whakatōtā. Ka whakatōtātia te hauwai me ngā hinu hei whakaehu; e takoto ana te hinu hā i runga. (He āhua rite tēnei whakaehu ki te ranunga wai/hinu e whakatōtā ana i runga i ngā papa mātao o te kihini, e waihotia ana he tewe i muri rawa atu i te whakamaroketanga). Mā ngā āhua ā-mahi a ngā umanga, ka whakawehea ēnei hinu hā mai i tēnei whakaehu e ngā matū whakarewa, matū tātari hoki. I te mutunga mai ka waihotia he hinu hā kore para, tino kaha, he nui rawa atu hoki te utu.

Ētahi Atu Ngohe

He rīpene ataata tīmatanga
He rawe te kete rīpene atatata Biodiversity in Aotearoa: *Walking the Talk*. I whakaputaina tēnei e *Greenpeace*, ā, i tukuna e te *New Zealand Biodiversity Strategy*. Ka whakaaturia e tēnei rīpene ataata e toru ngā arotahinga, 10 mineti te roa o ia arotahinga, mō te whakanui rerenga kētanga rauropi. Ko te *Magic Mānuka* te rīpene tino hāngai o ēnei ki tētahi aronui mō ngā hinu hā. E whakaaturia ana tēnei i te mea kua noho te mānuka hei pūtake mō tētahi mahinga hokohoko whakahirahira i te Tai Rāwhiti. He painga tō tēnei rīpene mō tētahi aronui hangarau e torotoro ana i ngā āhuatanga ahurea, o te hapori rānei, mō te whakawhanake iheutanga hauwai hei hoko.

He mea whakaatu tēnei rīpene i ngā momo huarahi hei whakamahi i tēnei hua. Kāore e taea te tango i tēnei kete mai i te *School Library Service*, engari i tukuna ki ngā kura tuarua katoa mō te kore utu i te tau 1998, nā reira tērā pea ka pai te tono mai i tētahi o ngā kura tuarua o tō rohe.
He tokomaha ngā kaumātua e matatau ana ki ngā rongoā Māori o ō rātou rohe. He pai mēnā ka noho tētahi o aua kaumātua hei kaiwhakataki i ngā momo kōhaki, whakamahi hoki a te Māori i aua rongoā mai rā anō.

Ngā Āhua-ā-mahi Kōhika mō te Akomanga

He āwhina mēnā ka hāngai ngā hātepe, ngā āhuatanga mahi hoki, ki te āhua o ngā akomanga, rūma hangarau rānei, i roto i ngā kura. Ko ia o ngā āhuatanga e whai ake nei he pai mō ngā momo matū tupu e hāngai ana ki aua āhua-ā-mahi. Tērā pea ka tīpakotia e ngā ākonga tētahi momo matū tupu, me tētahi āhua-ā-mahi kōhika hei whai mā rātou. Hei whakaritenga, whakaaturia ētahi o ngā āhua-ā-mahi kōhika; tāutu rānei me te tono ki ngā ākonga ki te rangahau i ia hātepe me te whakatau ko ēhea ngā tupu, wāhanga tupu rānei, e tika ana mō ia hātepe.

Ka whakamahia he hinu kawe mō ētahi o ēnei āhua-ā-mahi e whai ake nei. He hinu māmā te hinu kawe, arā, kāore he tino haunga, kāore hoki he matū whakakaha. Ko tā te hinu kawe he waimeha, he whakamārara hoki i te hinu hā. Ko te whakaraupapa utu e whai ake nei, mai i te utu iti iho ki te utu nui atu: Ko te hinu kākano hua wāina, te hinu oriwa māmā, te hinu aramona me te hinu pirikōti.

He Tūpatotanga

Ko ētahi āhua-ā-mahi kohika e whakaaturia ana i raro iho nei he mea whakawera, koropupū rānei i ngā ranunga i runga tārahu. Me mahi e te pouako hei ngohe whakaatu, me āta tiaki e te pouako rānei ina ka mahia e ngā ākonga anō.

Kohikatanga Hauwai

Purua he kete, kua rainatia ki te mata tarapī, ki rō kōhua pēhanga. Whakawhāititia ngā tupu ki roto i te kete. (He whakaaro anō, takaia ngā rau, puapua rānei ki te tōkena naiona). Hauwaitia ngā matū tupu i raro pēhanga āhua nui tonu mō ētahi mineti ruarua. Tangohia te matū tupu, tiakina te wai – ko te wai e toe ana he whakaehu hinu hā me ētahi atu matū ka taea e te wai te memeha. Kia tangohia te hinu hā mai i te whakaehu, ringihia te whakaehu ki roto ipu karaehe, tāpiritia 50 ritamanomano hinu kawe māmā, kātahi ka tino kōroritia. Waihotia mō te pō, kātahi ka tangohia te hinu kakara kua wehea mā tētahi ngongo iti. He pai tēnei āhua-ā-mahi mō ngā puapua rōhi (engari me maha tonu ngā puapua), te mānuka, te purūkamu, te taru kākaramea-tawa, me te rōhimere.

Whaonga Hinu Māhana

Rūmakihia te tupu ki te hinu kawe i rō kōhua, tētahi ipurau, tētahi ipu karaehe rānei ka āhei te whakawera, kātahi ka āta whakamahana i runga tārahu kia kore e koropupū te ranunga; mēnā ka koropupūtia ka taona te matū tupu. Kōroritia mo te 30 mineti, neke atu rānei, ki te wā e tino rangona ana rānei te kakara o te tupu i rō hinu kawe. Tangohia te kōhua mai i te tārahu; waihotia te ranunga kia mātao tonu – kia tū mō te kotahi hāora neke atu rānei. Waiho kia tū mō te pō mēnā ka taea. Mā tēnei hātepe ka whao i ngā hinu hā ki te hinu kawe. I te mutunga, tātaritia te matū tupu. He pai tēnei āhua-ā-mahi mō te nuinga o ngā matū tupu, arā ko te rōhi, ko te mānuka, ko te purūkamu, ko te taru kākaramea-tawa, ko te rōhimere, ko te rōkara, ko te kamamīra, te pepahīoi, te pīra o ngā huarākau pērā i te ārani, te whenera, te kopi, te tierēniamu, me te tāima.

Te Korotētanga

He āhua-ā-mahi tēnei hei kohika i te hinu o ngā huarākau pērā i te ārani me te rēmana. Tīhorea, waruwaruhia rānei o waho tonu o te pīra, ā, ka korotētia te pīra kia puta te hinu kātahi, ka ngongoa e te hautai iti kia mau i te hinu. He āhua uaua te kohika hinu pēnei, engari he āhua rite tonu ki te hātepe kohika hinu hei hoko. He pai te korotētanga mō te kohika hinu mai i te kiri tae o waho tonu o ngā huarākau pērā i te ārani me te rēmana.

Te Whaonga Wai

He āhua rite tēnei mahi ki te mahi tī. Riringihia iho te wai koropupū ki runga rau, puapua rānei. Tutua te ranunga mō te pō kia whao i te matū tupu ki roto i te wai, kātahi ka tātaria te matū tupu māro, me te āta whakarewa i te wai. He pai tēnei āhua-ā-mahi mo ngā matū tupu ngohegnohe, arā ko ngā rau tierēniamu me ngā putiputi kamamīra. Kāore ngā matū āhua māro tonu, pērā i ngā rau rōhimere, e tino whakaputa i te hā i rō wai.

Kohikatanga mā te Koropupū

He pai tēnei āhua-ā-mahi mo ngā matū āhua māro tonu, arā ko te kiri rākau, te rārā, ngā hua maroke rānei. Hei tīmatanga, rūmakihia te matū tupu ki te wai mātao, whakaweratia kia koropupū, ā, koropupū tonutia mō te kotahi haora, kātahi ka tātaria. Ka whakamahia tēnei momo kohikatanga mō te hinamona me te rōkara.

Te Kohikohi Tepe

E kitea ana ngā tepe i rō rau tupu tuawhiti, pērā i te arowēra. Ka pai noa iho mēnā ka tangohia mā te māripi, kātahi ka korotētia mā te papanga tarapī. Ka pania tōtikatia ngā tepe ki te kiri hei whakaora i te wera, te wero o te ngārara, te kōpukupuku rānei.

Te Whakarite Rongoā i rō Waiwaihā

Kāore i te tika kia whakaritea te rongoā i rō waiwaihā i roto i te akomanga i te mea he rongoā hei inu te nuinga o aua momo rongoā. Heoi anō, tērā pea he painga o te whakaatu i te āhua-ā-mahi o tēnei rongoā ki ngā ākonga kia mōhio rātou ki ngā momo kohikatanga maha.

Hei whakarite rongoā i rō waiwaihā, tutua te matū tupu ki rō waiwaihā mō te āhua rua wiki. Ka whakarewatia te waiwaihā i ngā matū whakakaha, he mea tiaki hoki te waiwaihā i te rongoā. Koirā te take ka tiakina ngā painga o tēnei momo rongoā mō ngā tau maha. He nui ngā āhuatanga whakaora o taua rongoā; arā, ko te āhua whakamahi whakarewatia ētahi kōpata ruarua ki rō wai. He paihana ētahi momo waiwaihā. Nā reira kāore e whakamahia te wai ewaro me ētahi atu momo waiwaihā paihana mō te whakarite i tēnei rongoā. Mō te whakaaturanga a te pouako, he mea marutau mēnā ka whakamahia te 25% wairewa waiwaihā hinu mewaro.

Te Tiaki Kohikatanga Tupu

He āhua tere te piro o ngā kohikatanga he wai te pūtake. Mēnā ka rerekē haere te haunga o te kohikatanga, he tohu tēnei kua tīmata te āhua piro. He āwhina mēnā ka purua ki rō pāka tio, engari kāore e tiakina pērātia mō ake tonu atu. Engari anō, he roa kē atu te tiaki i ngā kohikatanga hinu mēnā ka āta hīratia, ka waihotia ki tētahi wāhi kāore he tino mārama hoki. He mea pai hoki mēnā ka tiakina ki rō pātara karaehe, he pōuri hoki te tae. Kāore i te tino pai ngā ipu kirihou, me ngā hīra rapa, i te mea ka taea e te hinu hā te whakarewa i aua mea. He mea whakaroa i te tiaki o ngā kohikatanga hinu hā mēnā ka purua ki rō pāka tio.

Te Whakamahi Hinu Hā hei Taru Rongoā

Mēnā ka aro ki te kaupapa kakara whakaora, me ētahi atu āhuatanga whakaora, tērā pea ka whakapakarihia te whakaaro ki ētahi atu āhuatanga whakaora. Ka pai mēnā ka patapatai ngā ākonga ki ō rātou whānau, ki te hapori rānei o te rohe, kia whakarārangihia ngā mate ka taea te whakaora mā ngā tupu whakaora: Hei tauira, ko te tokopā, ko te ahotea, ko te tīkākā, ko te mamae monamona, ko te ohoroa, me te marū. Kia kaha te kōrero atu, ahakoa he painga tō ngā tupu whakaora mō ngā mate maha, ehara i te mea me whai i tēnei huarahi tupu whakaora anake me te kore uiui i ngā tākuta mō ngā mate o te tangata. He tohu ētahi mamaetanga o ngā mate taumaha. Mēnā ka ngaua tonutia te tangata e te mamae mō tētahi wā āhua roa tonu, me haere ka tika ki te tākuta.

He pai mēnā ka rangahaua te hononga o ngā kohikatanga tupu me ngā mate ka whakaoratia e aua kohikatanga whakaora. Ka taea te rangahau i aua āhuatanga mā te titiro ki ngā pānui hoko, ngā pukapuka o ngā wharepukapuka rānei mō ngā kaupapa tupu whakaora, kakara whakaora, me te rongoā Māori. He rawe hoki te kohikohinga pukapuka o te *School Library Service*. He painga anō tō te ipurangi mō aua momo mōhiohio. Hei tīmata i te kaupapa rangahau, ka arotahi ngā ākonga ki ētahi mate ruarua tērā pea ka taea te whakaora mā ngā tupu whakaora, me te rangahau i ngā momo whakaora ka whakamāmā ake i aua mate. He whakaaro anō, ka tāutuhia ētahi tupu rongoā ruarua ka taea te kohi i tō rohe, me te rangahau ka whakaora aua tupu i ēhea mate.

Mēnā he poto te wā, he pai ki te waiho tēnei rangahau, whakapotohia te wā rangahau rānei. He maha ngā pukapuka mō ngā tupu whakaora e whakarārangihia ana ngā mate me ngā momo tupu whakaora ka whakaora i aua mate. Kia tāutuhia e ngā ākonga tētahi tangata e ngaua e tētahi mate māmā, me te hono i taua tangata rā ki tētahi āhuatanga whakaora kei roto tētahi matū whakakaha, me mōhio rātou pēhea te kohika me te whakamahi i taua āhuatanga whakaora. Kua whakamārama kētia ngā tino hātepe kohika. Ko ētahi o ngā āhuatanga whakamahi i ngā momo whakaora ko te wera i ngā hinu whao i rō mura hinu (kakara whakaora), te pani hei hinu mirimiri, te riringi ki rō kauranga, te whakapiripiri i ngā kohikatanga he wai te pūtake, hei whakapiripiri wera, mātao rānei, te pani tōtika hei tepe, hei pani horomata, hei matū whakakaha i rō rongoā pani, kirīmi rānei.

Hei ngohe anō, ka kohikatia e te ākonga ētahi matū tupu me te kohika i ngā matū whakakaha, ā, ka whakaritea i te hua whakamutunga, me te tāpiri i ngā pākete me ngā tohutohu whakamahi mā te tangata whakamahi i aua whakaora. Mēnā ka āta mahia tēnei mahi, he roa te wā hei whakaoti pai. Mēnā he roa rawa tēnei akoranga, whakawhāititia ngā momo mahi hangarau kia mahi tētahi rōpū i te tupu kotahi, te mate kotahi, me te hua kotahi. Hei tauira, ko te whaonga hinu taru kakaramea-tawa. Ka pai mēnā ka whiriwhiri te rōpū me pēhea te tuku i te hinu taru kākaramea-tawa ki ētahi kaitono he rerekē te hiahia. Me rerekē te pākete me ngā tohutohu mō ia kaitono.

Pēhea te Mahi i te Rongoā Pani me te Kirīmi

Ka mahia te rongoā pani mai i ngā matū wākihi pērā i te hinu mewaro, te pī ware, me te tepe hinu Māori. Kāore he wai o ēnei, ā, ka takoto i runga i te kiri o te tangata, kāore e ngongoa ki roto i te kiri. Kia mahia he rongoā pani, ranungia 25 karamu pī ware me 100 ritamanomano hinu kawe whao i tētahi ipu, kēne pīna rānei (Ko te painga o te whakamahia i rō kēne, ehara i te mea me horoi i taua momo ipu i muri atu). Whakawerahia te ipu i roto i tētahi kōhua wai kia rewa ai te pī ware, me te ranu i te hinu. Tangohia te ipu mai i te wai wera kātahi ka tino kōroritia te ranunga. Ka āhua māro tonu te rongoā pani, nā reira riringihia ki rō ipu karaehe i te wā e mahana tonu ana (engari kia kore e wera, kei pākarkaru te karaehe). Kia ngāwari ake te rongoā pani, me iti iho te pī ware ki roto i te ranunga.

Kei roto i te kirīmi te wai me ngā matū whakaehu, arā ko te wai whakaehu, nā reira ka ngongoa e te kiri. Mō te mahi kirīmi, whaia te āhuatanga mahi mō te mahi rongoā pani, engari tāpiritia 25 ritamanomano wai wera (whaonga waiwera rānei), kotahi kōpata i te wā, ki roto i te ranunga wākihi-hinu. Kōroritia i ngā wā katoa kia whātoka, kia matao hoki i te kirīmi. Mēnā kei te hiahiatia, tāpiritia te wai whakaehu (ka taea te hoko i te nuinga o ngā toa hokohoko). Ko tā te wai whakaehu he whakatairewa i te hinu, me ngā matū he wai te pūtake, kia ngāwari ake te kirīmi. Mēnā kei te hiahia tāpiri wai whakaehu, kōroritia ētahi kōpata ruarua i te wā e mātao haere ana te ranunga. Kia mahia paoro hopi, riringihia tētahi kapu whā *Lux* ki rō oko ngaruiti ka āhei te whakawera, kātahi ka kōroritia e 3 pūne rahi wai ki roto. (Tērā pea me whakamātau i ēnei whātautanga. Tāpiritia ētahi kōpata hinu hā ruarua, kātahi ka tino whakawerahia mō ngā hekena 10 i te wā, ki te wā ka taea te hanga paoro mai i te matū. Takaia ia paoro ki te papanga tarapī, kia mātao, kia whātoka hoki.

Kia mahia he rehu whakakākara, tāpiritia āhua 10 kōpata waiwaihā hinu mewaro kia āhua 50 ritamanomano kohikatanga wai. He mea tiaki tēnei i te kohikatanga he mea tino whakakaha hoki. Riringihia te ranunga ki rō pātara rehu. (Mā te whakaatu a te pouako me te āta tiaki a te pouako te whakamahi i te waiwaihā hinu mewaro i roto i ngā kura tuatahi). I ngā wā katoa mēnā kei te whakamahi waiwaihā hinu mewaro, me tūwhera ngā matapihi o te akomanga puta mai te hauhau.

Hangarau me te Pāpori

Kua whakatakotoria i runga ko ngā āhuatanga o te whenu Hangarau Mātauranga, Hangarau āhei hoki. Kia aro atu ki te kaupapa Hangarau me te Pāpori, ka pai mēnā ka tirohia e te ākonga te whakamahi i ngā hinu hā hei whakaora i te tangata, hei mahi kakara rānei, i ngā rā o mua. Mō tēnei āhuatanga, he pai mēnā ka aro ki te ahurea Māori, ētahi atu ahurea o Te Moana-Nui-a-Kiwa, te ahurea Pākehā, te ahurea Āwherikana, ngā rongoā Hainamana rānei. Ka pēhea e rerekē ai te oranga o ētahi iwi o te ao mā te mahi ā-umanga i te kakara, kakara whakaora ranei? Kua rerekē te tirohanga a te pāpori ki ngā whakaoranga kē, mai i ngā tau o mua? Hei tauira: Kua rerekē ngā whakaaro o te iwi whānui ki ngā whakaoranga e rerekē ana ki ērā i whakamahia ai mō te nuinga

o ngā tāngata, arā, ko ērā o ngā tākuta Pākehā? Hei tauira anō : I haerēre haere te kaihokohoko hua *Rawleighs* ki ngā rohe maha, me te hoko i āna rongoā. Ko te tikanga ka whakaora i te tangata. Ahakoa i whāia rongoā kē e ngā tāngata ruarua noa iho i waenganui i tērā rautau kua pahure ake nei, i tino whakaohoohotia te hiahia ki aua rongoā i ngā tau mai i te tau 1970. He mea pai mēnā ka uiui ngā ākonga i ētahi tāngata – ngā kaumātua, whāea, mātua rānei – ki te kohikohi whakaaro, waiaro hoki, ki rongoā kē. He mea whakahirahira mēnā ka uiuitia ngā tākuta e whakamahia ana i ngā rongoā mō te nuinga o ngā tāngata o Aotearoa, me ngā tohunga, tāngata anō rānei, e whakamahia ana ngā rongoā kē. He tino pai hoki mēnā ka whakarite i te rerekētanga o ngā ahua-ā-mahi o nāianei, mā ngā hangarau hou, ki ērā o mua.

Mā te arotahi ki tētahi hua hei mākete mō tētahi momo kaihoko, ka taea te whakamātau i te waihanga me te whakamātau i ngā pākete. Mā te pērā ka tirohia e te ākonga te whakawhitiwhitinga i ngā hangarau hou. Mēnā ka haere ngā ākonga ki ngā toa hokohoko hua whakaora, ka mōhio rātou ki ngā momo hua taru whakaora e hokona ana, ki ngā momo pākete, momo tokonga rānei.

Ngā Hononga ki ngā Marautanga

Te Reo Māori: Te tirotiro ki te tuhi tohutohu mā te ārohi i ngā mōhiohio i runga i te tohu whakapiripiri o tētahi hua kua hokona kētia, arā te pātara pāhukahuka horoi makawe, wairongoā taru rānei; te whakawhitiwhiti i ngā mōhiohio e hiahiatia ana e te kaihoko hei whakamahi i runga i te marutau, kia whai hua hoki. Tātarihia hoki ka pēhea aua mōhiohio e whakaaturia ana (Me rangahau hoki i ngā whakahau a te ture mo aua whakaaturanga); Me whakaaro ake hoki he aha ngā āhuatanga reo ka whakarata i te tangata ki ngā momo hua e hokona ana; whakawhitiwhiti hoki i ngā painga me ngā āhuatanga kāore i te tino pai hoki, o ngā rongoā o te tākuta me ngā rongoā o kui mā o koro mā; Tērā pea mā te whakarite whakaari kei roto ngā momo tākuta, tohunga me ērā atu tāngata ko ā rātou mahi he whakaora i te tangata, me ētahi atu tāngata o te iwi whānui.

Ngā Toi: Waihanga tohu whakapiri me ngā pākete mō tētahi momo hua whakaora, me tētahi momo rōpū kaitono. Me whakaaro mō ngā momo tuhi mō te whakarata i te tangata, me ngā momo tuhi, ngā whakaahua, ngā tae me ngā momo whakatakotoranga.

"Te Ao Aruhe me te Pūkohu" me " Hine-rau-whārangi"

Ētahi Whāinga Paetae e Hāngai ana

Putaiao

Ō Mataora

- 3.1: Te whakawehe i ētahi rauropi i runga i ngā rerenga kētanga.
- 3.2: Te tūhura i ngā tino pūtake o ngā rauropi me te whakaatu i te whai pānga ki te oranga o aua rauropi.
- 3.4: Whakamārama, mā ngā mōhiohio i tirohia, i rangahaua i te whare pukapuka rānei, kei hea ngā wāhi noho o ētahi tupu, kararehe rānei, o Aotearoa.
- 4.1: Te tūhura me te whakarōpū rauropi me ētahi pūtake māmā te tirotiro.

Te Whakawhanake i ngā Whakaaro

Ko te tikanga, mā te pānui i "Ao Aruhe"me "Hine-rau-whārangi" ka mārama ake ō ākonga ki ngā whakaaro mātāmua e whai ake nei:

- Ngā āhuatanga o te aruhe mē ētahi atu momo tipu pēnei i te pūkohu
- Ngā āhuatanga tipuranga o ngā mea otaota
- Ko te hinengaro Māori, wairua Māori i roto i ngā āhuatanga pūtaiao
- Ko te whakataurite i te whanaungatanga ki ngā pūnaha mātauranga e rua kia āhei ai te kite i te hononga atu ki te mātauranga Pākehā.

Ahakoa e tupu huhua ana ngā aruhe me ērā atu o ngā momo tipu pēnei i te pūkohu i ngā wāhi maha o te ngahere, me ētahi atu wāhi o Aotearoa, kāore e tino kitea ngā aruhe me ngā pūkohu pērā i ngā tupu tino kukuwhā, arā ko ngā rākau hua inohi, me ngā tupu whaipua. Koirā te take kāore pea ō ākonga e tino matatau ana ki ngā āhuatanga e pā ana ki ngā aruhe me ngā pūkohu. Mā te torotoro atu ki tēnei kaupapa aruhe me te pūkohu ka taea ai e te ākonga te arotahi ki ngā rautaki rerekē mō te kawe wai o roto o ngā tupu. Mā te torotoro atu ki tēnei kaupapa kawe wai e taea ai te āta whakaaro i ngā herenga o te taiao mō ngā rauropi.

He Mōhiohio Tautoko

Te Kawe Wai

Kāore he tino matū kawe wai o ngā pūkohu, engari anō, he kōkai tā te aruhe mō te kawe kai, he kōtai hoki mō te kawe wai. Koirā te take ka taea e te aruhe te tupu huhua ki ngā wāhi maha, ā, engari kāore e maha ngā wāhi e taea ai e te pūkohu te tupu. Ko te take e taea ai ngā aruhe te tupu ki ngā wāhi maroke ko te mea ka taea e te aruhe te kawe wai mai i ngā pakiaka ki ngā tātā me ngā rau. Ahakoa ka taea e te aruhe te tupu i ngā wāhi maroke, he pai ake te tupu i ngā wāhi haukū, takawai rānei, pērā i ngā ngahere whakamarumaru.

He pūtau kawe waiwai i roto i ngā tātā o ētahi momo pūkohu. He āhua ōrite ēnei pūtau ki ngā pūtau kawe waiwai o ētahi aruhe tōmua. Ka kawe wai hoki ngā iarau o ngā rau o ētahi momo pūkohu. Arā, mō te kawe wai, e tata ana ngā pūkohu kukuwhā ki te whiwhi pūnaha kawe wai o roto o te tupu. Engari, mō te nuinga o ngā pūkohu ka kawe wai o waho noa iho o ngā tātā me ngā rau, ā, ka ngongo wai tōtikatia.

He Take Whakawhitiwhiti Kōrero, he Ngohe Hoki

He Ngohe Māmā

Mēnā kua pānuitia "Te Ao Aruhe", kua rite ngā ākonga ki te whakahaere i tētahi whakamātau kia kite i ngā rerekētanga o te ngongotanga o ngā momo tipu pēnei i te pūkohu me ngā rau aruhe. Kohia he kohikohinga pūkohu, kātahi ka waihotia kia maroke ki tētahi wāhi mahana mō ētahi rā ruarua, kātahi ka tirohia e te ākonga

pēhea te nui o te wai ka ngongoa e te kohikohinga pūkohu. Mā te whakamahi i tētahi pūoto ine, ngoiti kirihou rānei, ka taea ai te āta riringi ētahi kōpata wai ki te wā ka tīmata te turuturu i ngā taha o te kohikohinga. Mēnā ka aro ngā ākonga ki te rahi o te wai kua ngongoa, he pai mēnā ka whakamātauria pērātia ētahi rau aruhe maroke, āhua rite te rahi. Ka kitea, kāore he nui te wai ka ngongoa e te aruhe. Patapataia ngā ākonga mēnā ka mahara rātou ki te mōhiohio i whakatakotoria mō te kawe wai o roto o ngā aruhe. Whakamāramatia kāore he tino matū kawe o ngā pūkohu, nā reira me kawe wai o waho o ngā rau me ngā tātā, ā, ka ngongoa tōtikatia aua wai. Koirā te take ka tino ngongo tōtika te pūkohu i te wai.

Te Āhua o te Rau Pūkohu

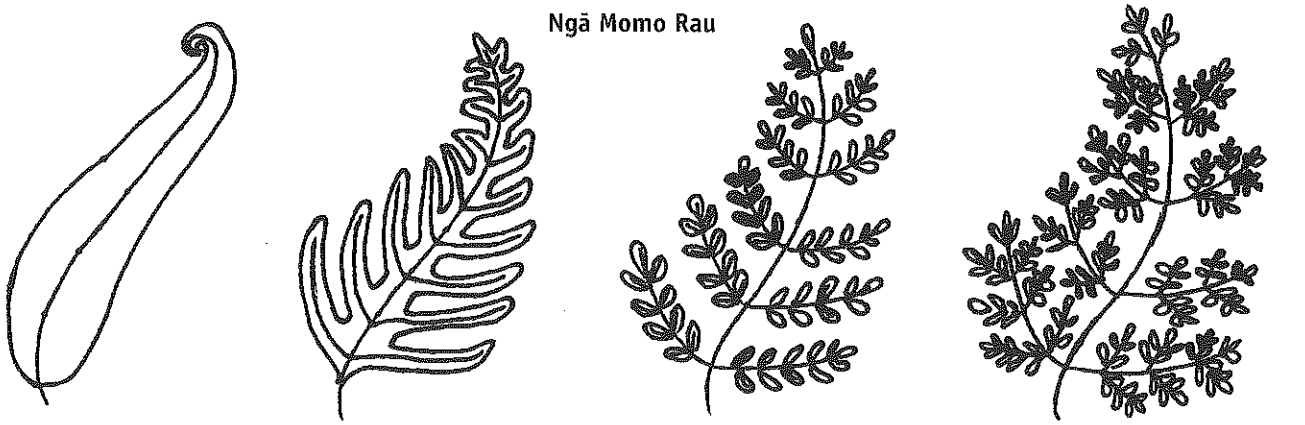
Ko te tino take o te rau pūkohu ko te ngongo wai. Kāore te nuinga o ngā rau o te tupu e ngongo wai pērā i te rau pūkohu. Engari, ka ngongo haukū mā te rau ētahi tupu. Koirā te take ka ora anō ngā tupu i rō kāinga mā te rehu wai.

I te tīmatanga, whakawhitiwhiti whakaaro mō ngā ariā whānui noa iho. Whakaaro i ngā ākonga mā ngā pātai pērā i tēnei tauira: "Ki ō koutou whakaaro he nui, he mātotoru, te āhua o te nuinga o ngā rau pūkohu?" He iti he tino angiangi ngā rau pūkohu, i ētahi wā kōtahi takotoranga pūtau noa iho te mātatoru. Ko te take mō tēnei: me noho tata ngā pūtau ki te wāhi o waho o ngā rau hei ngongo wai. Hei tauira anō: "He maha ngā rau tupu e mau kiri wākihi. Ki ōu whakaaro he āhuatanga pērā nō te pūkohu?"
He whakaaro: Tohaina ētahi rau kamīria kia rongo ngā ākonga ki te āhua wākihi o aua rau. Ko te āhua o te kiri rā he pūpuri wai. Kua ngongoa aua wai e ngā pakiaka, kātahi ka kawea ki runga ki ngā wāhanga o te tupu. Mēnā he kiri pērā tō te pūkohu, kāore e tino taea te ngongo haukū mai i ngā wāhi e noho ai aua tupu. Hei tauira anō: "Ki ōu whakaaro ka noho wehe ngā rau pūkohu?" Ka piri tata ngā rau pūkohu i huihuinga, ā ka pūpuri wai pērā i te hautai. Mēnā ka noho wehe ngā rau, kāore e ngongo wai pērā i te hautai, me te mea ko ngā rau angiangi, kore kiri, ka tere tuku wai i te pupuhitanga o te hau.

Ngā Āhuatanga o te Mōkehu

He nui ngā rerekētanga o te āhua o ngā rau o ngā momo aruhe. Ka tohu ēnei rerekētanga i ngā momo aruhe, arā, mā te kite ka mōhio te tangata ki ngā momo aruhe. Ko ngā wāhanga o te aruhe ko te tātā, arā te wahanga ka mau i te rau o te mōkehu ki te wāhi tika. Ko te rara o tēnei ko te wāhanga o te tātā e pūpuri ana i nga rau. I ētahi wā kāore i te noho wehe te mōkehu, he tauira ko te *bird's nest fern*. I te nuinga o te wā, ka noho wehe te rau ki ētahi wehenga rau. Ka pupiritia ia wehenga rau e tētahi iarau o waenganui. Ka puta ngā wehenga rau i ngā taha e rua o te rarā o waenganui, takirua, noho hohoko rānei. Tērā pea ka wehea anō ngā wehenga rau hei wehenga tuarua, ā, i ētahi wā ka wehea anō hei wehenga tuatoru.

Ngā Momo Rau



He mōkehu **He mōkehu mata raukura** **He mōkehu mata raukura rua** **He mōkehu mata raukura tengi**

He mea pai mēnā ka tirohia ētahi pukapuka e ngā ākonga kia kitea tētahi momo aruhe o Aotearoa e whakaaturia ana ia momo rau. He pai hoki mēnā ka kohia, ka tiakina, ka whakaaturia hoki ētahi momo rau o ngā aruhe – tērā pea ka whakaaetia te tango i ngā tauira aruhe mai i ngā māra o te tangata, i ngā pārae o te Kaunihera rānei, e tata ana ki te kura, kāinga rānei.

He Ngohe Anō
He Haerenga

Kei te whārangi 108 o te tuhinga *Making Better Sense of the Living World* he ngohe i waihangatia kia arotahi i ngā hinengaro o ngā ākonga ki te whai pānga o te wai ki ngā wāhi tupu ai te pūkohu me te aruhe. Mēnā e tata ana koe ki tētahi ngahere, ka taea ai e te ākonga te whakahaere i tētahi tirohanga e tohu ana i ngā wāhi ka kitea te nuinga o ngā pūkohu me ngā aruhe: Me ngā wāhi tupu ai aua tupu. Me ārohi mēnā he mahere ki tēnei momo whakamāraratanga; āta tirohia te nui o te mārama ki ēnei wāhi me te nui o te wai ki ēnei wāhi. Hei tauira; tērā pea ka tau ō rātou whakaaro ki te take, ahakoa ka tupu tahi te pūkohu me te aruhe ki ngā wāhi mākū, ka taea ai e te aruhe te kuhu ki ngā wāhi marokē, engari anō ko te pūkohu ka noho ki ngā wāhi mākū. Ka aro pea te ākonga ki te whakaaro ka tupu huhua te pūkohu ki te taha o te rākau e anga ana ki te tonga, arā kāore tēnei taha e tino whitia e te ra, ā, he āhua mākū tonu i ngā wā katoa.

I roto i te wāhi o te kura tonu, ka taea ai e te ākonga te whakahaere i tētahi tirohanga anō. He rerekē te māraratanga o ngā aruhe mēnā ka whakatōngia e te tangata. Ko te mana whakatupu he mea i runga i te whakaaro o te kaitiaki māra – engari i te nuinga o te wā ka whakatōngia ki ngā wāhi marumaru, mākū tonu hei whakatō i te aruhe. Ka taea e te pūkohu te tupu ki ngā wāhi kāore he wai – mēnā he āhua poto tonu te wā kāore he wai. Koirā te take ka kitea te pūkohu i runga i ngā toka, i runga raima me ngā papa pereki o ngā māra e whitia ana e te rā mō ngā wā poto. Ko ngā pūkohu pērā ka maroke haere, ā, ka parauri te tae mēnā kāore he wai, engari ka kākāriki anō ina ka whakamākūkūtia anō. Ka kitea tēnei āhuatanga e ngā ākonga ina ka tukuwai ki tētahi kohikohinga pūkohu maroke.

He pai hoki mēnā ka tirohia ka rangahaua rānei ngā momo ngārara me ētahi hātaretare anō e noho ana i roto, e tata ana hoki, ki ngā wāhi tupu ai te pūkohu.

He Mōhiohio Tautoko
Te Pūkohu me te Ao Hokohoko

Kei roto i te *New Zealand Geographic*, Nama 7, Hongongoi – Mahuru 1990, he tuhinga e pā ana ki te momo pūkohu tino ngongo wai pērā i te hautai. Ko te ingoa o tēnei pūkohu ko te *sphagnum moss*. Kōrerotia i roto i tēnei pukapuka te umanga *sphagnum moss* i te Tai Poutini o Te Waka o Māui. I ngā rā o mua ka nui te wāriu o tēnei pūkohu hei ārai huakita, ā, inaianei ka wāriutia hei matū ngaki tutukiwi. Ka whakamāramatia e tēnei tuhinga te kohikohi me te whakarite o tēnei momo pūkohu mō ngā mākete nui te rawa ki tāwāhi.

Te Kukuwhātanga o te Tupu

Mō ngā tamariki pakeke i roto i ngā kura tuatahi, he pai mēnā ka tātaritia e ngā ākonga te whai pānga o te ao tupu ki ngā hononga kukuwhā – mā te pērā ka mōhiotia te noho o te matū kawe i roto i te whānuitanga o te ao tupu. Tērā pea ka rangahaua e ngā ākonga te whānuitanga o te hītori o te kukuwhātanga tupu mō rātou anō; ka hoatu e te pouako rānei ngā mōhiohio mēnā he pai ake te aro ki ngohe kē, atu i te rangahau pukapuka. He tino kaupapa tēnei, ka noho ngā pūkohu me ngā aruhe i ngā taha e rua o te whakarōpūtanga tupu, arā ko te taha whai iarau (he matū kawe) me te taha iarau kore (kāore he matū kawe o roto).

Kapoke

E ai ki ngā tohu anga pōhatu, ko ngā kapoke te tuatahi o ngā tupu. Ko ēnei momo tupu iti i puta moata ai, i whakawhanaketia āhua 550 miriona tau i mua i roto i ngā moana whai ōpapa o taua wā. Ko ngā kapoke o ēnei rā ka tīmata mai i ngā mea otaota moana pūtautahi mōkitokito, mai i ngā hāware ki ngā rimurimu nui rawa atu. Ko ngā kapoke mōkitokito (otaota moana) he mea tupu huhua rawa atu, he pūtake hoki ki ngā tāhuahua o te moana, o te wai māori hoki. Koirā te take ka whakaarohia ko te otaota moana ko te pārae nui o te moana. Ahakoa he mea tupu te nuinga o ngā kapoke i roto i te moana, ka tupu ētahi momo kapoke i runga whenua mākū – arā ko te oneone, ko ngā papa rākau, me ngā toka. Kua waia ētahi momo kapoke ki te noho i roto i te huruhuru o te pea-pōturi.

Kāore he tino pakiaka, tātā, rau rānei o te kapoke. Kāore he tino matū kawe, tautoko rānei, i te mea ka rūmakitia i rō wai. He maha ngā rimurimu ka whakamaua ki te papa tū tonu, mā tētahi hanganga, he pakiaka te āhua – ka whakaingoatia tēnei ko te pupuritanga, ka hono ki ngā mōkehu roa e nukunuku ana i roto i te wai. He ōrite te kapoke ki ngā tupu katoa, arā he ahotakakame, ēngari kāore ngā mōkehu me ngā wāhanga e wehea ana ki ngā momo matū maha pērā i momo tupu kē. Engari, kei roto i ngā tātā o ētahi momo rimurapa tētahi aho whai pūtau āhua rite ki ngā matū kawe o ngā tupu iarau.

He paratau kore te āhua o te uritanga o te kapoke mā te whakawehe, te whakakongakonga, te whakamatikao, te whakaputa pata rānei. He mea paratau hoki te whai uri mā te whakaputa ira toa, ira kouwha hoki (kano me te tātea) hono ai, ā, ka whakatupu hei tupu hou. Ko te nuinga o ngā momo kapoke ka whai uri paratau kore, uri paratau hoki. I te nuinga o te wā ka whai hua te uritanga paratau kore kia tere te tupu ki wāhi kē i ngā wā papai. I ētahi momo, he ruarua noa iho ngā wā whai uri mā te hono i te kano me te tātea – ka pērātia anake i ngā wa kore wai kore kai rānei – i aua wā ka noho te huanga (hononga tātea me te kano), ā, ka tatari ki te wā he nui te kai, wai rānei. Ka rerekē anō ēnei āhuatanga i ngā wāhi maha, ā, kāore e tino taea te kī he aha ngā āhuatanga – he rerekē anō hoki mai i tētahi momo tupu ki tētahi.

Ngā Tupu Whai Pata

I puta tuatahi te tupu e 400 miriona tau i mua. Ko ngā tupu whenua tuatahi ki te puta ko ngā pūkohu, ngā aruhe me ētahi tupu anō o ngā wāhi mākūkū. Ka whai uri aua tupu mā te whakaputa kano, tātea hoki, ka whai uri paratau kore rānei mā te whakaputa pata. Ka kitea i roto i te pūkohu aua āhuatanga e rua i roto i te tupu kotahi, engari i roto i te hītori o te aruhe ka wehea, arā ētahi ka whai pata, ētahi ka whai kano me te tātea. He mōhiohio anō mō te whai uri o te pūkohu me te aruhe i roto i te whārangi Te Whakarea Aruhe.
He nui te kukuwhā o te whānau tupu pērā i te aruhe, te whiore hōiho me ngā mātukutuku, i te mea he tātā, he pakiaka he matū iarau nā aua tupu, e taea ai te tupu kia nui – he rerekē anō te pūkohu. I te wā o ngā moko tuari i tupu huhua ngā whiore hōiho me ngā mātukutuku, engari kāore i te pērā ināianei. Engari anō ko te aruhe, ka tupu huhua ki ngā wāhi maha.

Ngā Tupu Whai Kākano: Te Koroī me te Whaipua
Te Koroī me te Whaipua

I puta ngā tupu whai kākano āhua 300 miriona tau i mua. Kei runga noa atu aua tupu ināianei. E rua ngā tino momo tupu whai kākano: Te Koroī – ka tupu ngā kākano i rō hua inohi; me te Whaipua – ka whakahaetia ngā kākano i rō puāwai, ka māoa i rō hua i ētahi wā. Ko te rōpū Koroī nui rawa, ko ngā tupu whai hua inohi. Kei roto i ngā momo rākau hua inohi ko ngā paina, ngā *firs* me ngā *cedars*. He rākau hua inohi ētahi o ngā rākau taketake o Aotearoa, pērā i te kauri me te rimu. Ka tupu tere te rākau whai hua inohi. I te nuinga o te wā he tinana tōtika, teitei hoki. Ka tino hiahiatia aua rākau hei hoko. He mātotoru, he wākihi, he kiri māro hoki ō ngā rau o aua rākau. Ka taka ngā rau i ngā marama katoa, nā reira ka mau rau aua rākau i ngā wā katoa. Ka kaha te tupu o ngā rākau hua inohi ki ngā whenua makariri, pupuhia e te hau, ka maroke hoki. He ngahere rākau hua inohi tino nui rawa atu e tū ana ki Uropi ki te Raki, ki Rūhia me Amerika ki te Raki.

I puta ngā whaipua 150 miriona tau noa iho i mua, engari e 80 ōrau o ngā momo tupu nāianei he whaipua. Kei roto ngā uritanga o te whaipua i rō puāwai – he wāhanga toi, he wāhanga kouwha, tō te nuinga o ngā putiputi (engari i roto i ētahi momo whaipua ka noho wehe – arā, he puāwai toa, he puāwai kouwha). He titi kōnehu (he tātā te āhua), he putanga hae ki runga. He uhae tō te wāhanga kouwha o te puāwai, ā, ka honoa ki te kano mā tētahi tātā anō. Mā te pā o ngā pata hahae mā te uhae ki te kano ka whakahaetia. Ka honohia te matū ira toa ki te matū ira kouwha i roto i ia kano ka pua tētahi huanga e tupu ake hei kākano. Mō ētahi mōhiohio anō mō te whai uri o ngā whaipua, me ētahi atu ngohe, tirohia *Making New Plants*, pukapuka 26 o *Building Science Concepts* (Te Pou Taki Kōrero, 2002). Tirohia hoki whārangi 81 ki 88 o *Making Better Sense of the Living World* (Te Pou Taki Kōrero, 2001).

Ngā Ōritenga me ngā Rerekētanga

Ko te hinengaro Māori, wairua Māori i roto i ngā āhuatanga pūtaiao. Ko te whakataurite i te whanaungatanga ki ngā pūnaha mātauranga e rua kia āhei ai te kite i te hononga atu ki te mātauranga Pākehā.

Ko te whainga o "Hine-rau-whārangi", he āwina i te pouako ki te whakaako i te āhuatanga e pā ana ki te tipunga otaota i runga anō i ngā tikanga Māori, otirā, he whakatītina anō mō te tuku tirohanga Māori o te ao pūtaiao whānui. Ko tā Hine-rau-whārangi mahi, he whakakirikiri, he tiaki i te tupunga me te hurihuri o ngā momo tipu, tangata anō hoki. E ai ki ngā kōrero, nō te wehetanga atu o Hine Tītama ia Tāne, ka ngaro atu ki rarohenga, ā, riro ana ia Hine-rau-whārangi ngā āhua kawenga mahi a te wahine e tiaki. Kōrerotia, wānangatia ngā kupu e whai ake nei:

Ko ngā pū
Kua ruia te kākano ki raro i te whenua, ki roto i te whare tangata.

Ko ngā weu
Nā te kukune, ko te pupuke, ā, e whāngaia mai e te whenua.

Ko ngā more
Kua tino puta mai te akaaka ki te whenua, ā, kua kaha tipuināianei.

Ko ngā rito
Kua puta te rea ki te whaiao, ki te ao mārama, Tīhe Mauri Ora!

Ko ngā taketake
Ka kaha te tipu o te tinana i runga i te whenua, ā, ka pakari tōna hanga.

Ko ngā manga
Ka pakari ake ngā peka me ngā pakiaka, ngā ringaringa me ngā waewae.

Ko ngā pūkenga
He mārama te kite atu i ngā oritenga, engari he mārama hoki te kite atu kei tēnā, kei tēnā ōna ake āhuatanga, pūmanawa, rerekētanga hoki.

Ko ngā wānanga
Ko te tikanga o tēnei, ko te kimi māramatanga mā te noho tahi, mā te hui tahi, mā te wānanga tahi i ngā mea katoa ka pā mai ki a tātau.

Ko ngā taura
I kōnei ka kitea ngā hononga, ngā tuituinga, me ngā herenga e whakahonohono nei i a tātau katoa ki te tangata, ki te kararehe, ki te ika, ki te manu, ki te rākau, ki te tipu, ki ngā koiora katoa o te ao.

Ko ngā tauira
Nā, titiro ana tātau ki ēnei kōrero, mārama ana te kite atu he tauira tēnei. Koinei te tauira mō te tipunga o te otaota me te tangata, me kī, o ngā koiora katoa.

Ngā Hononga ki ngā Marautanga

Te Reo Māori: Hei tautoko, tuhi pūrongo pūtaiao i muri atu i tētahi haerenga rangahau i ngā āhuatanga o te pūkohu me te aruhe, me te māraratanga o ētahi momo tupu. (He pai ki te waiho ki ngā ākonga te whakarite i te mahere o aua pūrongo mēnā he māhea te pūrongo i te mutunga). He whakaaro anō: Ka aro ngā ākonga ki ngā aratohu tuhi pūrongo pūtaiao mā te whakarite i te pūrongo ki te wāhanga e whakaatu ana ngā mōhiohio e pā ana ki ngā pātai arotahi, he whakaaturanga o te whai i ngā whāinga o te patapatai, he whakaaturanga o ngā hua i puta – kei roto pea he mahere – me tētahi whakawhitinga kōrero mō ngā tirohanga.

Ngā Toi: Te hanga tētahi wāhi whakaaturanga (pērā i ērā o ngā whare tāonga) mō ngā aruhe me ngā pūkohu o Aotearoa. Whiriwhirihia he kaupapa i te tuatahi, me ngā momo matū hei whakaatu (tohu, pouaka whakaatu, tohu whakapiri e whakaatu ana i te kaupapa). Tērā pea he whakaaro ō ngā ākonga mō te hanganga o tētahi whakaaturanga.

"Whakatupua ā koutou ake Aruhe"

Ētahi Whāinga Paetae e Hāngai ana

Pūtaiao

Ō Mataora

- 2.3: Te tūhura kia mārama ngā rerekētanga i roto i te oranga o te kararehe, o te tupu
- 3.1: Te whakawehe i ētahi rauropi i runga i ngā rerenga kētanga.
- 4.2: Te tūhura me te whakamārama o ngā tino pūtake o ngā kararehe, o ngā tupu, kia ora ai whakatipuranga hou.

Te Whakawhanake i ngā Whakaaro

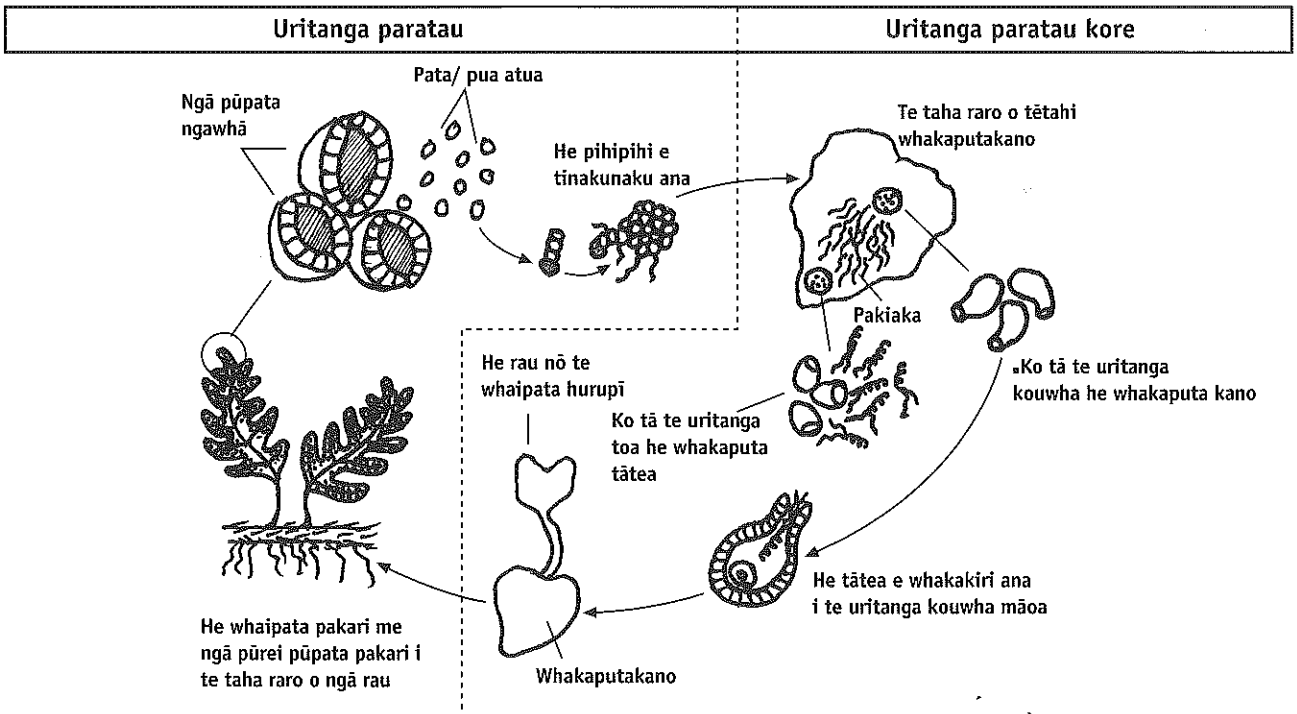
Te uritanga paratau, paratau kore rānei.

E rua ngā momo uritanga o te ao tupu: paratau, paratau kore hoki. Ka tirohia tēnei āhuatanga e rua ngā ākonga ina ka whakatupu aruhe rātou – ahakoa kāore i te tino kitea tēnei āhuatanga. Ina kua pānuitia ngā ngohe me te hanga pouaka whakatupu aruhe, ka wātea ngā ākonga ki te rangahau i te hītori o te oranga o te aruhe. Kia mārama rātou ki te uritanga paratau, paratau kore hoki, ka pai mēnā ka tirotiro ki te hītori o te oranga o ngā pūkohu. He rerekē te hītori o te oranga o te pūkohu ki te hītori mō te aruhe i te mea he tupu whaipata te aruhe; ēngari anō ko te pūkohu he tupu whakaputa kano, tātea hoki.

Mō ētahi mōhiohio tautoko, he ngohe hoki, mō te uritanga paratau, paratau kore rānei, o te tupu, tirohia ngā whārangi 80 ki 89 o *Making Better Sense of the Living World* (Te Pou Taki Kōrero, 2001).

He Ngohe Anō

Te Hītori o te Oranga o te Aruhe

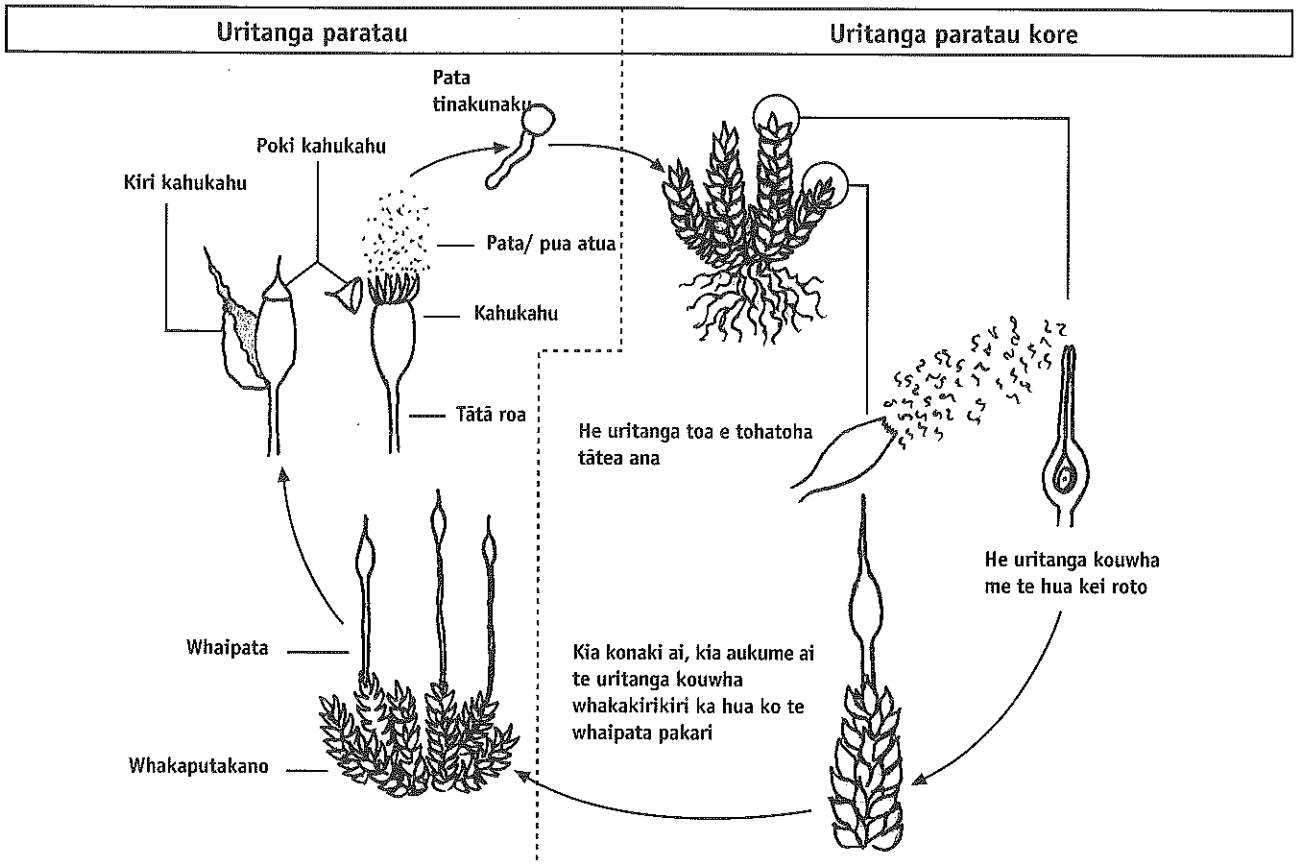


He pōturi te whakatupu aruhe mai i te pata, nā reira he roa rawa te wā mā ngā ākonga hei rangahau i te hītori o te oranga o te tupu i a rātou e tatari ana kia tupu ngā aruhe i roto i ā rātou pouaka aruhe. He uritanga paratau kore te pata, he mea puta te ira matū mai i te tupu matua kotahi – arā, te tupu matua. I roto i te whakaputa pata, kāore e ranu ngā matū ira mai i ngā tupu matua e rua. Mēnā ka taka te pata ki wāhi pai, ka pihi, ka tupu hei pihipihi.

He āhua rite te pihipihi ki te hawahawa. He kākāriki, he ahotakakame te pihipihi. Ka tupu ngā uritanga i raro i te pihipihi. He uritanga kouwha, he uritanga toa ēnei – ka motu, ka puta te tātea – mēnā he nui te wai, ka kaukau.

Mēnā ka tae te tātea ki tētahi uritanga kouwha māoa, ka whakahaetia i roto. Koianei te whaiuri paratau. Ko te kune ka puta, ka tupu hei tupu matua pakeke. Mēnā ka tika te whanaketanga, ka tupu pūpata i raro iho o ngā rau.

Te Hītori o te Oranga o te Pūkohu



I roto i te hītori o te oranga o te pūkohu, ko te tino tupu ko te pihipihi. Kia taea e te pihipihi te whai uri, ka tupu te kouwha me te toa. I ētahi momo pūkohu, ka tupu te toa me te kouwha i runga i te tupu kotahi – koirā ngā tupu paratau rua. I ētahi momo anō, ka noho wehe, arā he kouwha ētahi, he toa ētahi – koirā ngā tupu paratau wehe.

Rite tonu ki ngā aruhe, ka whakaputa tātea ngā toa i ngā wā ka tupu pai ngā uri. Ka rata ngā toa ki ngā kouwha māoa i runga tupu tata. I muri i te whakakikiritanga, ka puta tētahi whaipua mai i te kouwha, ā, ka piri ki te tupu matua. Ka kitea te pūpata pūkohu, ahakoa he iti iho i te pihipihi. I te nuinga o te wā, ko te āhua o te pūpata: He pūkoro whakaputa pata ki runga i tētahi tātā roa. Ina ka māoa, ka motu, ka puta ngā pata paratau kore. Mēnā ka taka te pata ki tētahi wāhi pai, ka tupu hei pihipihi.

Ko te Hītori Oranga o te Kararehe

He pai kia whakawhānuitia te kaupapa ki te titiro ki te hītori o te oranga o te kararehe hoki – tērā pea ko te whakawhanake i rō kōpū me ngā kōeketanga o runga ake i tērā. He whakaaro anō mēnā ka aro ki ngā wahanga o te hītori o te oranga o ngā kararehe e hangawainga toioratia ana. Tirohia *Animal Life Histories*, pukapuka 4 o te *Building Science Concepts* (Te Pou Taki Kōrero, 2000).

He Hononga Marautanga

Te Reo Māori: te tuhi pūrongo, kei roto ētahi mahere, e whakamārama ana i te hītori o te oranga o te aruhe me te pūkohu, tērā pea ka aro ki ngā ōritenga me ngā rerekētanga.

"Rata me tōna Waka" – He Pēhea te Teitei o Tēnā Rākau?

Ētahi Whāinga Paetae e Hāngai ana

Pāngārau

Ngā Āhuahanga

- Tuhia me te whakamārama i ngā mahere āwhata māmā. (Torotoroa atu te āhua me te mokowā, taumata 3).
- Whakanuia ki runga pepa tukutuku, ngā āhua māmā ki te āwhata hāngai pū (Torotoroa atu te hanga rite me te āhuahanga panoni, taumata 3).
- Hangaia ngā tapatoru me ngā porohita mā te whakamahi taputapu waihanga tika. (Torotoroa atu te āhua me te mokowā, taumata 4).
- Whakahangaia ngā hangaritetanga o ngā taparau (Torotoroa te hangarite me ngā panoni, taumata 4).
- Te whakanui me te whakaiti i te āhua ahu-2 me te tohu i ngā ahuatanga pūmau (Torotoroa te hangaiti me te panoni taumata 4).

Ine

- Ka taea te mahi inenga mā te whakamahi i ngā waeine me ngā āwhata rerekē (Whakatau tata me te ine, taumata 3).
- Kia tutuki ngā mahi ine e whakauru atu ana i te pānui āwhata ki te putu tino tata (Whakatau tata me te ine, taumata 4).

Mahi Taurangi

- Rapua me te parahau i tētahi tauira kupu mo tētahi mahi tūwaenga (Torotoroa te whārite me ngā kīanga taurangi).

Te Whakawhanake i ngā Whakaaro

Tapa Toru Rite

I te mahi whakawhānui (He Wero i Tua Atu), me whakaaro me mahi ngā ākonga i ngā ōwehenga pāngarau me ngā āwhata kia kitea ai he pēhea te teitei o te rākau. Ko te take nui ki konei ko te āroro o ngā tapatoru, he rite ngā koki, engari ko ngā taha he rerekē te roroa. Nga tapatoru āhua ōrite ko aua tapatoru rā anō, me mahi ki te āwhata rerekē. I mua i te tīmatatanga o ngā ākonga i te rapanga, me kōrerorero mō te āhua mahi o ngā tapatoru ōrite ki tēnei horopaki. Me āta titiro ki ngā whakaahua kei roto i a rātou pukapuka. Ka kite rātou mai i tēnei tirohanga ko te poro rākau he rite te āhua ki ngā taha rite o ngā tapatoru e rua. Hāunga ko te rerekētanga ko te roa o ngā taha, he rite pū tonu ēnei tapatoru. (I kō atu he tapatoru āhua rite.)

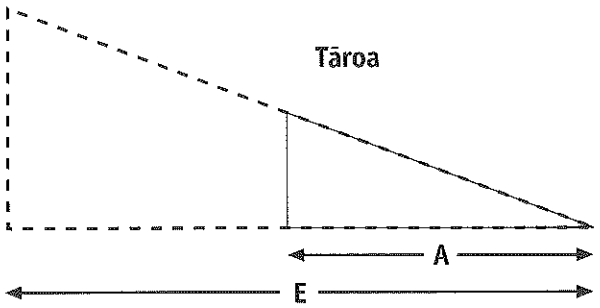
Ināianei me titiro ngā ākonga ki te whakaahua tuarua. Mā te nuku i te poro rākau ki te takotoranga pae, me te manu hei rere iho mai i te rākau ki te poro rākau, ki te tirohanga ka rite nei e tū ana i te pito o te poro rākau, kei te whakatakoto pararahi i ngā tapatoru e rua, mai i te hoahoa tuatahi (Ko ēnei tapatoru e rite pū ki ērā o te whakaaturanga tū tika). Mā te inenga o te tawhititanga mai i te take o te rākau me te hoa manu, ko te mahi he ine i te teitei o te rākau (mā te kore e kake).

Mehemea āu ākonga he ohooho me te māia i roto i te āhuahanga, ka taea mā rātou anō e ārahi ki te whakaoti i ngā wero whakapakari. Mehemea horekau āu akonga e tino māia ana, tēnā pea māu e whakamārama ngā ariā me ngā āhuatanga.

Torotoro Āwhata

Ka taea te tīmata mā te whakauru i ētahi ariā mō te tapatoru te ine me te āwhata. Whakamahia te hoahoa o ngā tapatoru āhuarite hei whakauru i te kīanga "tau rahi".
(He tauira pai tēnei hei tīmatanga nā te mea ko te roa o **A** he haurua i te roa o **E**, na tērā ka māmā ngā tātaitanga)

Whakamahia ngā ākonga ki te tautuhi i ngā āhuarite me ngā āhua rerekētanga i waenga i ngā tapatoru e rua. Ko te āhua ritetanga he rite tonu ngā koki. Te rerekētanga ko te roroa o ngā taha. Koia ngā tapatoru e rua, he rite pū, hāunga ko te nui anake. Ināianei me mahi ngā ākonga i te ine me te whakamārama i te pānga o te nui o te rārangi **A** me **E**. E tika ana kia puta te kī, he haurua te roanga o **E** i a **A**, Ko **E** he tānga rua te roa atu i a **A**. Mā te kaiwaihanga e huri taupoki te mātātuhi kia rite ai ki terā i mua atu, kia tika ngā inenga.



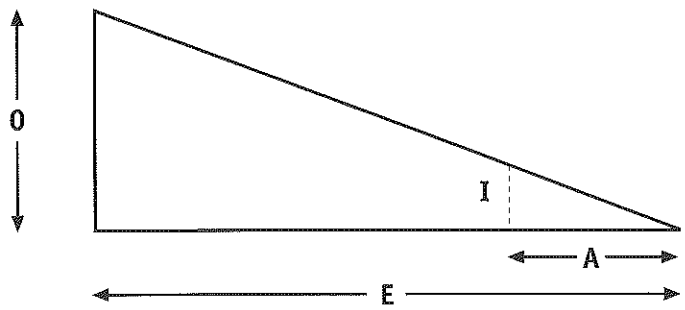
Mehemea e mōhio ana koe ki te roa o **A**, engari ehara i te roa o **E**, ka taea te mahi te roa o **E** mā te whakamahi i te ture:

Te roa **A** x taurahi = te roa o **E**.

Ko ētahi o ngā tauira me tohutohu me pēhea ka kitea te taurahi, ko ētahi me torotoro ka taea te whakautu i te pātai e rātou anō.

$$\text{Te taurahi ko } \frac{\text{te roa } \mathbf{E}}{\text{te roa } \mathbf{A}}$$

I konei ko te taurahi e rua (nō reira **A** x 2 = **E**) Ka ū tika tēnei ture, mā ngā ākonga e whakamahi te taurahi hei kohika he pēhea te roa o ērā atu taha. Tuatahi hoatu te roa o te taha ūtika o te tapatoru kua whakakūrukua, mā ngā ākonga e rapu te roa o tēnei taha o te tapatoru e wātea ana, kaua e inengia. Hurihia te raupapa mahi, mā te hoatu ki ngā ākonga i te roa o te tāroa o te tapatoru wātea, mā rātou e rapu te roa o te tāroa kei te tapa toru whakakūruku (I tēnei huringa, me whakawehe mā te taura). Kua torotoroa tēnei rapanga māmā, i konei ka whakaaro i te rapanga o te rapu o te teitei o te rākau. Mā te whakahāngai i ngā mātāpono kua mahia ra.



A x taurahi = **E** (te tawhititanga mai i te rākau). Nō reira **O** x tau rahi = **U** (te teitei o te rākau).

Ki ngā mahi whai take ko **I** te rākau e tū ūtika ana i te whenua. Ko te inenga **A** ko te tawhiti i waenga i ngā kanohi o te tangata me te poro rākau a te whakarārangitanga- a -kanohi ki te taha runga o te rākau. Tēnā pea ka hiahia koe ki te tārua, ko te take nui kia mahi tēnei āhua whakahaere, nā te mea he rite pū ngā tapatoru e rua, pānga ko te roa o ngā taha. Nā reira ka taea te whakamahi i ngā mātāpono āwhata kia kitea te inenga ngaro.

Ka taea te whakamahi te taurangi i te āhua o ngā tauira kua mahia: Taurahi = **E ÷ A**.

Mā ngā ākonga e mahi e rapu ētahi atu rapanga me ngā otinga, mā te tirotiro ki ētahi atu pūāhua ine i te kura i te kāinga rānei. A reira ka waihanga ai he mahere hei whakaahua i ēnei.

Ngā Mātāpuna O Te Hē

Me kōrerorero me pēhea ka taea e ngā ākonga ēnei momo ine ko rātou anake. Me whakaaro rātou mō ngā mātāpuna o te hē. Ko tētahi o ngā tino raruraru i tēnei āhua whakahaere ko te mea e kore rawa e taea e te tangata te whakarārangi i ōna kanohi kia tika pū ki te whenua – me keri anō he waikeri! Mā ngā ākonga e hoahoa e whakamātautau tūwaenga me ngā taonga e mōhiotia ana te teitei kia mōhiotia ai he pēhea te hōhonutanga o tēnei momo hē i roto i ngā mahi.
Mō te āhua whakamahi i te karaehe hei karo i tēnei hēnga mātāpuna, titiro i te whārangi 113 i te Tauaki Pāngarau.

He Ngohe
Te whakamahi ataata kia kitea te teitei o te rākau.

Tētahi atu āhua e kitea ai te inenga ngaro mā te whakamahi ataata, kei te pukapuka *He Rapanga Pangarau*. Titiro ki te inenga, taumata 3 – 4 (Te Pou Taki Kōrero 2001) i te whārangi tuatahi he mahi Ataata Tāmaru e whakamahi ana i taua mātāpuna o te kite me te whakamahi i te taurahi. Tika pū ka taea e ngā ākonga te ine i te roa o te ataata o te rākau, i taua wā tonu ka ine ai te ataata o te rauru kotahi mita te roa. Kātahi ka whakatairite ai ngā ataata o te rauru ki tērā o te rākau, kia puta ai te rau tahi, ka whakamahi ai tēnei tauwehe hei kohika i te teitei o te rākau, mai i te roa o te ataata. Anei anō, pātaia ki ngā ākonga kia whakaaro mō ngā pūnga o te hē. I tēnei huarahi, me pupuri poutū pū te rauru nā te mea ahakoa he iti noa te tīhoi mai i te poutū ka tino nui te whakarerēkētanga i te tika. Nō reira ka pai atu te whakamahi tāwēwē (he tuaina, he māhē me here ki tētahi pito)

Tūhura i te Whakanuitanga

Kei ngā pukapuka ākonga tēnā pea ka taea te whakauru atu he whakarahi. Ngā momo āhua ka tirohia e ngā ākonga kia uru atu ngā momo tapawhā, ngā momo taparima, ngā momo tapaono, me ngā hoahoa māmā o ētahi taonga.

Kei te *Whakamahi i te Pāngarau*, he tini ngā mahi e pā ana ki te āwhata me te whakanui i roto i ētahi horopaki hei whakauru atu i ngā ākonga ki te whakamahi tukutuku hei whakanui, hei whakaiti mātātuhi, me te waihanga ma te whakamahi mahere āwhata. Mō ngā mahi i te akomanga me ngā pātanga whakamārama, tirohia ngā pukapuka akonga me ngā tuhinga mā ngā kaiako (Ahuahanga taumata 3 me āhuahanga taumata 3, 4). (*He Rapanga Pāngarau* Te Pou Taki Kōrero 2000, 2001)

Ka whai hua mā ngā ākonga ki te whakahīato he rārangi mō ngā āhuatanga o ngā taonga me ngā āhua kua whakarerekētia mā te whakanui. Ko tētahi kaupapa me whakamahi e ngā ākonga ki te mahi papatau kia uru atu he rārangi mō ngā taonga kua whakanuia, me te rārangi mō ngā taonga kua whakaitia. Ngā rārangi ki te taha matau ka titiro whānui ki ngā pūnga mō te roa o te horahanga, te rōrahi, te nui o te koki, te āhua me te whakataunga. Mā ngā akonga e tohu ki te rīpene ki te māka rānei i ia whakatūranga, mehemea ka rerekē ngā hūanga.

	Roa	Horahanga (Taonga ahu – 2)	Rōrahi (Taonga āhua – 3)	Koki	Whakataunga	Āhua
Taonga kua whakanuia						
Taonga kua whakaitia						

Ngā kupu hou ka whakaurua atu ko te "taonga" me te "mātātuhi" hei whakaatu i te āhua o te taketake me te whakanuinga, te whakaitinga rānei.

Te Whakanui Horahanga

Te mea me mahara tonu ka whakanuia ngā āhua mā te taurahi, te roanga o ia taha me whakarau ngā taha mā tēnei taurahi, engari ko te rōrahi ka nui atu mā te (taurahi)2.
Hei tauira he tapawhā 1.5 te rōrahi he 2.25 mitarau 2. Mehemea ka whakanuia ngā taha o te tapawhā 1.5 mitarau, mā te taurahi 3 ko ia taha ka 4.5 mitarau te roa. Ka nui ake te horanga mā te taurahi pūrua (3x3=9). Koia, 2.252 x 9 = 20.252.
Mā te mahi me ēnei tātaitanga he mahi whakawhānui mā ngā ākonga māia.

Ngā Hononga ki ngā Marautanga

Ngā Toi: Waihangatia ētahi taitapa ataahua mō ngā pātū kia whakamahia te tāruarua, te whakanui, te whakaiti i ngā hoahoa (me te huringa hoki) kia whakatōpūtia ēnei kaupapa matua ki te whakaaritanga, e whakaatu ana i ngā ariā o ngā āhuatanga panoni; waihangatia he mahere hei whakaahua i ngā kaupapa mō te whakatautata i te teitei o te rākau, mā te iti o te tuhi ka whakaatu ai ngā ariā-ā-kanohi.

Reo Māori: Tuhia he pānui ki tōu hoa e whakamārama ana i te kaupapa mō te whakatautata i te teitei o te rākau, kia uru atu hoki ngā hoahoa hei āwhina i te kai pānui kia mārama ai ki tēnei tū ahua.

"Pāpapa"

Ētahi Whāinga Paetae e Hāngai ana

Pāngarau
Tatauranga

- Whakamahia he pūnaha hei tātai i tētahi huinga o ngā whāinga paetae ka taea (Te Toro i te Tūponotanga, taumata 3).
- Matapaetia te tūponotanga o ngā hua i runga anō i tētahi huinga o ngā mātakitaki (Te Toro i te Tūponotanga, taumata 3).
- Whakatau tata i te auau o ngā pāpono, ā, tuhia ki runga i tētahi tauine (Te Toro i te Tūponotanga, taumata 4).
- Kimihia ngā hua katoa tērā pea ka puta mai i tētahi raupapa pāpono, mā te whakamahi i te hoahoa rākau (Te Toro i te Tūponotanga, taumata 4).

Te Whakawhanake i ngā Whakaaro

I ētahi wā tika, ka hiahia koe ki te whakauru i ngā ngohe tūponotanga me ngā ngohe tatauranga mai i te tauira pūtere pāngarau a te Tāhuhu o te Mātauranga. E wātea ana ēnei i te paetukutuku TKI mā te kete aromatawai, mā te hapori pāngarau rānei. Whakatika atu ki te whārangi *mathematics exemplar* kei www.tki.org.nz/r/assessment/exemplars/maths/index_e.php

I muri i te pānuitanga o te pūrākau, e pai ana kia tākaro ngā ākonga i ngā whiringa e rua o Pāpapa. Ka mutu, ka haere tonu rātau ki te toro i te ariā, arā te tūponotanga. Mēnā kāore i tino tirohia te tūponotanga i tō akomanga i mua i tēnei, me āta whakamārama atu e koe ki a rātau, he aha te tūponotanga me te whakaatu anō hoki i te tūponotanga hei hautau.

Me whakahāngai i te titiro a te ākonga ki te whakaahua e whakaatu ana i ngā wāhanga o te tinana i ia kaitākaro ina wikitoria ai a Winitana i te whiringa tuatahi. Uia ngā ākonga kia pohewa, kei te haere tonu te tākaro me te tātai anō hoki i ngā heipūtanga ka makaia e Ngāpera he tau e riro ai i a ia te wāhanga e hiahia ana ia, arā, he waewae i tēnei wā. Me maka i te 1 kia whiwhi waewae ia. Ko ngā heipūtanga e puta ai he hua rorotu, 1 o ngā heipūtanga e 6. Uia mēnā i whakaaturia e tētahi o rātau tēnei tūponotanga hei hautau. Ki te kore tētahi, uia te hunga ākonga kia whakaaro me pēhea e whakaatu pēnei ai rātau i te tūponotanga, arā (1/6).

Ināianei, uia ngā ākonga kia kimi ture whānui e pā ana ki te rapu, ki te whakaatu rānei i te tūponotanga:

$$\text{Ko te tūponotanga o tētahi hua} = \frac{\text{te maha o ngā hua rorotu}}{\text{te maha tapeke o ngā hua katoa ka taea}}$$

Kātahi, inoi ki ngā ākonga kia whakamahi i ngā hautau hei whakaatu i te tūponotanga e riro ai i ia kaitākaro he hua rorotu i tērā maka a rātau. Hei tauira, e hiahia ana a Te Kōtuku ki tētahi waewae, ki tētahi parirau, me tētahi weri. Ki te riro i a ia aua wāhanga, e hiahia ana ia ki te 1, 3, 4 rānei. Nā te mea, e toru ngā tau ka riro i a ia he hua rorotu, ko te heipūtanga ka riro i a ia he hua rorotu mai i ia maka, e 3/ 6, tērā pea ka whakarāpopotohia ki te 1/2. (ko te pānga [te tau i runga] me te tauraro [te tau i raro] ka taea te whakawehe mā te 3.)

Inoi ki ngā ngā ākonga kia whakamārama, i roto i ā rātau ake kupu, he aha i whakatau ai a Te Kōtuku, "Ko te mea uaua rawa, ko te maka i te tau e hiahia ana koe i te tīmatanga me te mutunga o te kēmu." Ā, "ka tere haere te kēmu i waenganui." Ka tono pea koe ki ngā ākonga kia tuhia ā rātau whakamārama i runga anō i ngā whakaaturanga a Winitana ki tōna pāpā. Kei roto hoki i te tauira e whai ake nei ngā kōrero matua me āta mau i ngā ākonga.

"E 6 ngā tau i runga i te maka rota. I te tīmatanga, me maka i te 6 kia whiwhi koe i te tinana o te pāpapa. Ko te tikanga o tēnei, ko te tūponotanga e riro ai i a koe te tau e hiahia ana koe, kotahi o ngā heipūtanga e 6 (1/6 rānei). I muri i tērā, e hiahia ana koe ki te upoko kia āhei koe ki ngā weri, ngā whatu, te kauae rānei – engari ka āhei anō koe ki ngā waewae. Nā reira ko te heipūtanga e 2 o te 6(2/6, 1/3 rānei).

"Kātahi, ki te riro i a koe te upoko, ka piki te heipūtanga e makaia ai tētahi tau e hiahia ana koe ki te 4 o te 6(4/6, 2/3 rānei) nā te mea ka whai wāhi te 4, te 3, te 2, te 1 rānei. Heoi, i waenganui o te tākaro, he āhua tere tonu.

"Engari i muri i tērā, ka heke anō te heipūtanga. Ki te maka koe i te 2, ā, ka riro i a koe te kauae, ka hiahia noa iho ki tētahi 4, tētahi 3, tētahi 1 rānei. Nā reira ka heke ō heipūtanga ki te 3 o te 6(3/6, - rānei). Ā, nā te mea e 6 ngā waewae e whāia ana e koe, i te mutunga ka hiahia koe ki te 1, nā reira ka hoki koe ki te 1 heipūtanga o te 6, pērā anō i te tīmatanga."

Ina mau ai i ngā ākonga ngā whakaaro matua o ngā tātaitanga tūponotanga, ka hoki ake ki te whakaahua. Werohia ngā ākonga kia tātai i te tūponotanga e riro ai i a Ngāpera he hua rorotu, ki te whiua e ia ngā maka rota e rua i te wā kotahi. (Ko te tātaitanga whakamutunga, 11/36, ka tae ngā ākonga ki tēnei whakautu mā te tatau i te tau tapeke o ngā kōwhiringa katoa ka taea mai i te whiunga o ngā maka rota e rua [36], kātahi, ka tāpirihia katoatia ngā kōwhiringa e pai ana [11]. Ko te tūponotanga ka riro i a Te Kōtuku he hua rorotu, he 27/36, ka whakarāpopototia ki te 3/4.)

Te Whakamahi i ēnei Whakaaro i roto i tētahi Horopaki Rerekē

Ko tētahi huarahi hei whakawhānui ake i ēnei whakaaro ki te horopaki kē, he toro i te tūponotanga, i tētahi ākonga ētahi āhua pū (arā whatu kikorangi, he kotiro). Uia ngā ākonga kia tuhia tētahi ripanga o ngā āhua whārite me te tatau anō hoki i te tokomaha o ngā ākonga i a rātau rā ēnei āhua. Kei raro tētahi tauira.

Āhua	Tokomaha o ngā ākonga i a rātau tēnei āhua
Whatu kikorangi	10
He kotiro	15
He mārehe	7
I whānau mai i tāwāhi	4

Mā tēnei ngohe e whai huarahi ai ngā ākonga ki te whakanui ake i tō rātau mōhio ki a rātau anō, tētahi ki tētahi, i a rātau e pātai ana, e kohikohi raraunga ana mō rātau anō.

Ka mutu te kohi raraunga, me āta tātai ngā ākonga i te tūponotanga, i tētahi o rātau (kāore e āta whiriwhiria) aua āhua katoa. (Mai i tērā ngohe, me mōhio ngā ākonga ka taea te tūponotanga te whakaatu hei hautau). Ko te tokomaha o ngā ākonga i a rātau te whakaritenga te pānga, ā, ko te tokomaha o ngā ākonga katoa o te akomanga te tauraro.

Āhua	Te tokomaha o ngā ākonga i a rātau tēnei āhua	Te tūponotanga i tētahi ākonga tēnei āhua
Whatu kikorangi	10	$\frac{10}{30}$
He kotiro	15	$\frac{15}{30}$
He mārehe	7	$\frac{7}{30}$
I whānau mai i tāwāhi	4	$\frac{4}{30}$

Ki te tika, me āta whakatenatena i ngā ākonga ki te whakarāpopoto i ngā hautau. Hei whakahono i tēnei ngohe ki te tikanga whānui mō te whakaatu i te tūponotanga, tēnā pea ka tuhia e koe tēnei tauira ki runga i te papa tuhituhi:

Ko te tūponotanga he kotiro koe i rūma 6 =
te tokomaha o ngā kotiro i rūma 6 / te tokomaha o ngā ākonga i rūma 6 = 15/27

Kia mahara, he tīpako noa iho ēnei otinga. Ka tīmata pea koe i tētahi kōrerorero mō te mea, mēnā ka pā ēnei tūponotanga ki ētahi atu akomanga o te kura, ki ētahi atu kura o te taone rānei – ki te kore, he aha ai? Uia ngā ākonga ki te āta whakaaro, he aha pea ngā otinga i ētahi atu kura, ā, i muri i tērā me āta kōrerorero i ngā tikanga mō te tango noa i ētahi tīpako.

He Ngohe Anō

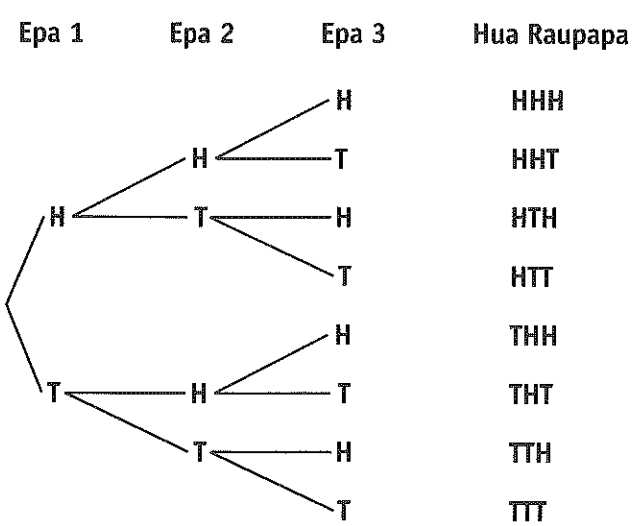
Ka taea e koe tētahi pūranga kāri te whakamahi ki te whakapiki ake i te mōhio ki te tūponotanga. Kōrerorerotia te tūponotanga e unuhia ai tētahi kāri whero, tētahi hāte, tētahi hai rānei mai te pūranga kua horahia. Kātahi ka whakamātauria e ngā ākonga te tūponotanga.

Hei tauira, tangohia ngā tioka, ko te heipūtanga ka whiwhi kāri whero he 1/2. Ko te tikanga o tēnei, mō ngā kāri e rua ka whiriwhiria noatia, kia kotahi te kāri whero. Ko te tūponotanga ka whiwhi hāte he 1/4. I runga anō i tēnei, ki te tīra ngā kāri e whā, ka heipū mai ko te kāri kotahi hei hāte. Heoi anō, ko te waihanga ripanga e whakaatu ana i ngā pāpono me te tūponotanga o ngā hua, hei taonga āwhina.

Uia ngā ākonga ki te matapae i ētahi atu hua, kātahi whakamahia te pūranga kāri hei whakamātau mēnā he pono. Ka taea ano ēnei te whakamātau mā te noho taurua me te pere kapa kia 100 ngā wā, ka tuhituhi haere i ngā hua, arā he upoko, he hiku rānei me te whakahoki kōrero ki te akomanga. Ka kite pea rātau he tata tonu ngā pāpono ki ērā i matapaetia, ahakoa kāore e pērā i ngā wā katoa.

Ko tētahi tikanga hei āta whakaputa ki ngā ākonga, he motumotu te tūponotanga. He motumotu ia pāpono, ā, kāore he pānga o ngā hua o mua. Hei tauira, ahakoa i makaia e koe ngā upoko e 100 o te 100, ko te tūponotanga ka makaia he hiku kāore e nui ake i te 1/2.

Ka toro hoki ngā ākonga i te tūponotanga mā te hoahoa rākau. Hei tauira, mā te whakaatu i ngā hua ka taea ina makaia ai te kapa kia toru ngā wā.



Ka kite ngā ākonga ko te tūponotanga ka makaia he upoko e toru, he 1/8, ā, ko te tūponotanga ka makaia he kōwhiringa me ngā upoko e rua kei roto, he 3/8. Hei ngohe whakapakari, ka toro ngā ākonga i ngā huarahi e pā ana ki te whakarau i ngā tūponotanga motuhake kia puta ai te hua kotahi. Hei tauira, ko te tūponotanga ka makaia he ūpoko, he 1/2, nā reira ko te tūponotanga o te maka i ngā upoko e toru he 1/2 x 1/2 x 1/2 = 1/8 (0.5 X 0.5 X 0.5 = 0.125).

Ka taea ēnei te whakamahi me ngā maka rota e ono ngā taha, e whai wāhi ana ki te horopaki o te Pāpapa. Ka tuhia hoki e ngā ākonga he hoahoa rākau mō ngā maka rota, he rerekē te maha o ngā taha.

Me āta whakatenatena i ngā ākonga ki te rapu i ētahi atu horopaki, ka taea ngā hoahoa rākau te whakamahi ki te kimi i ngā hua katoa ka taea me ngā tūponotanga.

Kātahi pea ka titiro te akomanga ki te wāhi o te tūponotanga i ētahi atu tākaro. Ka hari mai ngā ākonga he huinga o ngā tākaro papa hei toro i ngā āhua huhua o te heipūtanga me te pūkenga ka toa ai tētahi tangata. Hei tauira, i te Mana Tokitoki *(Monopoly)*, ka whai wāhi te tūponotanga ina whiu ai ngā kaitākaro i te maka rota, tango kāri ai i ngā pūranga Huarahi anō *(Chance)* me te Pūtea ā-Hapori *(Community Chest)*. Ka whai wāhi te pūkenga inā whiriwhiri ai te kaitākaro e hia ngā moni kei roto i te pēke me te aromatawai anō hoki mēnā he whai kiko te moni rēti ka hoki ki a ia mai i te hoko rawa.

Mā te kōrerorero anō hoki i te Rōtō (*Lotto*) e whanake ai te ariā, e hāngai pū ana tēnei nā te mea ko te tikanga o te rapu i te tūponotanga, ka tangohia tētahi tau, ka kore e whai wāhi anō. Nā reira ka heke mā te kotahi te tau tapeke o ngā hua katoa ka taea ia wā.

Ka hoahoa, ka waihanga anō pea ngā ākonga i ā rātau ake tākaro. Me whakatenatena i a rātau kia whakauru atu i ngā āhua o te heipūtanga nui atu i te kotahi, pērā ki te whiu maka rota, te tango kāri, te maka kapa rānei. Ko te Pāpapa, ko te ngangara rānei hei kaupapa mā rātau, ā, ko te wīrā whakahuri ka whakakī i te wāhi ki te maka rota.

Ngā Hononga ki te Marautanga

Ngā Toi: te waihanga hoahoa mō Pāpapa me te whakauru i ēnei hoahoa ki roto i ngā tākaro ka whai wāhi ai te heipūtanga. Hei tauira; mā te hoahoa tākaro e whakaata mai ana ngā tae, ngā whakaahua me te whakatakotoranga i ngā ture me te haere o te tākaro; mā te hoahoa pānui whakaahua hei whakatauira he pēhea te whakaatu i ngā tātaitanga tūponotanga me ngā hoahoa rākau, e whakaaro pū ana mō te whakamahinga o te ata nui rawa te pānga *(high-impact visual imagery)* me te whakamahinga whakamoamoa, tōtika hoki o te kupu tuhi.

"Hine Kawakawa"

Possible Achievement Objectives

Technological Areas
Production and Process Technology
Biotechnology
Materials Technology
Drawing and Graphics
Science

Material World

- 3.2: Investigate and describe how the physical properties of materials are related to their use.
  3.3 Investigate and report on temporary and more permanent changes that familiar materials undergo.
- 4.2: Investigate and explain how uses of everyday materials are related to their physical and simple chemical properties.
- 4.3: Investigate and describe ways of producing permanent or temporary changes in some familiar materials.

Living World

- 3.2 Investigate special features of common animals and plants and describe how these help them to stay alive.

Developing the Ideas

By reading "Hine Kawakawa", "Hine-rau-whārangi", and "Pāpapa", your students will gain an understanding about the following main concepts:

- Some genealogies relating to the forest
- Some practices relating to Māori medicine.

Rongoa Māori

Historically, Māori used a wide variety of indigenous plants for medicinal purposes. The philosophy and practice of this traditional herbalism is known as rongoa Māori. Many aspects of rongoa Māori have been maintained up to the present day by certain families, most of whom still live in their ancestral tribal areas.
Māori have a close affinity with the natural world through the philosophy of whakapapa (genealogy). According to this world view, all aspects of the natural world belong to a single family that traces its ancestry back to the Creation. All living things are thus bound together by whakapapa, at the heart of which is mauri (the life force that exists in all living things and binds the world together). It is said that Tāne is the god of the forest and that all things of the forest originated from him. Millions of years ago after the seperation of Rangi and Papa, Tāne sought many maidens for himself.

Here are some of those genealogies:

Tāne ∓ Apunga
Kawakawa

Tāne ∓ Hine Tītama
Hine-rau-whārangi

Tāne ∓ Punga
Tū te wanawana
Ngarara
(ko ngā mea ngōki)

Tāne ∓ Rerenoa
Rata
(me ngā akaaka pikipiki)

Tāne ∓ Mumuwhango
Tōtara

Tāne ∓ Para-uri
Weka, a haere-awaawa

Their offspring were the many and varied plants of Aotearoa, which in some areas are considered to be tūākana (older siblings) by the tangata whenua.

The skill of preparing and administering plants for medicinal purposes was handed down through the generations of particular families who carried the responsibility of maintaining the physical and spiritual wellbeing of their whānau, hapū, and iwi. Remedies could be made with either a single plant or a combination of many. Medicines were prepared completely separately from food and food utensils.

In pre-European times, rongoa Māori was used to combat many illnesses, including leprosy and tuberculosis. Internal treatments were used for: respiratory ailments such as bronchitis, asthma, and coughs; stomach, bowel, and urinary tract problems; and menstrual and birthing difficulties. External treatments were administered for a wide range of skin problems, including burns, boils, eczema, leprosy, and warts as well as for bleeding and wounds.

For a number of years, Ministry of Health officials have been in dialogue with traditional healers, Māori health providers, and iwi regarding the role of traditional healing in relation to mainstream services. The medicinal benefits of rongoa have been supported by scientific studies, some of which include the analysis of related medicinal plants in other parts of the world.

In 2001 and 2002, the Foundation for Research Science and Technology (FRST) has been managing Te Kete a Tini Rauhanga, a research team investigating rongoa Māori as practised by Tūhoe. This team is led by Dr Meto Leach of the University of Waikato. Dr Leach and his research team have been working with respected tohunga rongoa (Māori medicine expert) Hohepa Kereopa of Tūhoe. Their aim is to record and document the selection, preparation, and uses of medicinal plants by Tūhoe and to identify the bioactive compounds that confer the medicinal properties.

The Medicinal Properties of Kawakawa (Macropiper excelsum)

The following information should not be used as a basis for self-medication because, in many cases, it has not been scientifically verified. Kawakawa has relatives that are used medicinally in other Pacific countries, for example, the kava plant. Kawakawa is abundant in many of New Zealand's lowland forest areas from Northland to Canterbury. It is a distinctive plant because of its heart-shaped leaves, which are often riddled with holes caused by insect browsing.

Kawakawa can be used internally to tone the kidneys and to alleviate stomach problems. Externally it is used for cuts, wounds, boils, abscesses, and nettle stings. It can also be used for rheumatism and other aches and pains, including toothache. When kawakawa is burnt on a campfire, it reputedly repels mosquitoes.

Developing the Ideas

After the students have read "Hine Kawakawa", a good way to advance the topic of fragrant plants would be to discuss the idea that smelly substances can strongly affect how we feel. Beginning on a general level, you could ask the students which smells and fragrances appeal to them and which repel them. For example, we often find floral scents and other plant fragrances appealing, but the smells associated with putrefaction and decay have the opposite effect. Can the students think of how an animal's positive or negative responses to various smells benefit either the animal or whatever is producing the smell? For example, our retching response to the smell of rotten food means that we are very unlikely to try eating it. Similar responses to the smell of body wastes mean that we are likely to avoid places in which there is a high risk of contagion. From this general consideration of our response to smells, you could narrow the focus to those smells that are produced by plants.

Why Plants Produce Aromatic Oils

A plant's fragrance results mainly from its production of essential oils – potent aromatic substances that may be

found in flowers, buds, stems, leaves, roots, or bark. These oils were once thought to contain the essence of the plant – hence the name. For centuries, they have been used for healing because of their wide range of medicinal effects. Ecologically, their purpose is usually to attract or repel animals. For example, fragrant substances can attract bird or insect pollinators to flowers. Fragrances may signal to animals that a plant's fruit is ripe for eating or collecting, which helps to ensure that the seeds are dispersed. Strong aromas may also act as deterrents to grazing animals, particularly when produced in a plant's leaves. This strategy is employed by mānuka and eucalyptus plants. Some essential oils also have antifungal and antiviral properties. Kawakawa leaves have long been used by Māori to make antibacterial poultices for treating boils and other infections of the skin. (For more information about traditional medicines, see the Rongoa Māori section later in these notes.) In some cases, however, essential oils are simply waste products.

You could lead the class in a brainstorming session to come up with a variety of animals that are affected by plant aromas. For example, cats simply can't resist rolling in catnip, which tends to make them relaxed and sleepy. Also, many students will be aware of aromatherapy oils, which have various properties and benefits.

How Do Essential Oils Work?

The active chemical agents in essential oils enter the body via the linings of the respiratory tract when inhaled or via the pores of the skin if applied in a cream, oil, or ointment. The chemicals then pass straight into the bloodstream and rapidly move around the body, affecting the chemical balance of various organs. Aromatic chemicals can have a particularly rapid effect on the brain. The chemicals eventually leave the body in the sweat, urine, or breath.

Safety Warning

Because essential oils can be very potent, there are safety issues to take into account if you use or experiment with them in school. They should never be drunk or eaten. And there are some that shouldn't be used on babies or pregnant women, particularly in a concentrated form. All the plants mentioned in these notes are safe to use, and the active ingredients will be present in the extracts in low concentrations.

The Commercial Extraction of Essential Oils

The perfume recipe quoted in the article uses the method of hot water infusion to extract essences from the kawakawa flowers. (This product has to be used quite soon after preparation as it doesn't keep well.) Commercial extractions of flower perfumes use complex "absolute" extractions since the oils are often too delicate to boil. These methods involve volatile solvents, such as hexane, in which the essential oils dissolve during extraction. Such solvents are allowed to evaporate off afterwards.

Steam distillation is the commercial method for extracting essential oils from foliage. This involves complex pressure cookers attached to condensers. Steam is generated, and the plant material is heated under pressure in the superheated steam. The essential oils in the plant evaporate with the steam and are carried by it as it moves down a condensing tube. The vapour and oils condense into a watery emulsion with a layer of pure essential oil floating on top. (This emulsion is similar to the water and oil mixture that condenses onto cold surfaces in a kitchen, leaving an oily film long after it has dried.) The essential oils are separated from this emulsion commercially with solvents and filter materials. The end product is pure essential oil, highly potent and very valuable.

Further Activities

A Starter Video

There is an excellent video kit called Biodiversity in Aotearoa: Walking the Talk. Put out by Greenpeace and distributed by the New Zealand Biodiversity Strategy, the video presents three 10-minute case studies about valuing biodiversity. In particular, "Magic Mānuka" would be relevant to a unit on essential oils. It shows how mānuka has become the basis of an exciting export industry on the East Coast. This video could be a valuable

feature of a technology unit because it explores the cultural and social aspects of developing a commercial steam distillation process. The video also describes various uses of the product. Unfortunately, the kit is not available through the School Library Service, but all secondary schools received it free in 1998, and so you may be able to borrow it from your local secondary school.

Many kaumātua have local knowledge of how to use indigenous plants as remedies. You could invite a speaker to introduce the topic and describe traditional methods of extraction and application.

Extraction Techniques for the Classroom

Given the constraints of working in classrooms and even technology rooms, some shortcuts and simplified processes may be helpful. Each of the following methods suits a particular range of plant materials. You may wish to have the students choose a plant material and an extraction technique that they would like to try. In preparation for this, you could either describe the range of extraction techniques to the students or simply name them and ask the students themselves to research what each process involves and which plants and plant parts each process suits.

Some of the following techniques involve the use of carrier oils. These are light, mild oils with neither a strong smell nor active chemical properties. The carrier is used to dilute and spread an essential oil. In order of increasing cost, useful carrier oils for classroom technology activities include grapeseed oil, light olive oil, almond oil, avocado oil, and apricot kernel oil.

Safety Warning

Some of the extraction techniques described below involve heating or boiling various mixtures over a hotplate. Such activities should be carried out either as a teacher demonstration activity or as a student activity under very close adult supervision.

Steam Extraction

Place a basket lined with a fine mesh into a pressure cooker. Pack the plant material into the basket. (Alternatively, you can wrap the foliage or petals in clean pantyhose.) Steam the contents under medium pressure for a few minutes. Then remove the plant material and retain the liquid, which will be an emulsion containing essential oils as well as many other water-soluble substances. To recover the essential oil from the emulsion, pour the liquid into a large preserving jar, add 50 millilitres of a light carrier oil, and stir the mixture vigorously. If you leave it to settle overnight, you can then use a plastic pipette to draw off the layer of fragrant oil that has separated out on top of the liquid. This technique is useful for rose petals (although you need a large number of them), mānuka, eucalyptus, lavender, and rosemary.

Warm Oil Infusion

In a saucepan or a Pyrex jug or beaker, cover the plant material with carrier oil and heat it gently over a hotplate. Don't allow the mixture to boil because this will cook the plant material. Keep stirring for a minimum of 30 minutes or until you can easily smell the fragrance of the plant in the carrier oil. Remove the container from the heat and allow the mixture to cool and steep (soak) for at least an hour. (If time allows, steeping overnight would be ideal.) This process allows the essential oils to infuse into the carrier oil. Finally, strain off the plant material. This technique works well with most plant materials, including those from rose, mānuka, eucalyptus, lavender, rosemary, clove, chamomile, peppermint, citrus peel, fennel, ginger, geranium, and thyme.

Expression

This technique is used for extracting the oil from citrus fruit. Peel, scrape, or grate the very outer layer of the peel and squeeze the oil out of it. Then use a small make-up sponge to absorb the oil. This is a tricky technique but it's similar to the commercial process. Expression is useful for extracting the oil from the zest (outer, coloured skin) of grapefruit, oranges, and lemons.

Water Infusion

As described in the students' book activity, this technique is like making tea. Pour boiling water over the leaves or flowers. Allow the mixture to steep overnight so that the plant material infuses the water, strain off the solid plant material, and gently evaporate the water away. This technique works best with soft plant materials, such as geranium leaves and chamomile flowers. Tougher plant materials, such as rosemary leaves, don't readily surrender their essence in water.

Decoction

This technique is useful for tougher materials like bark, twigs, or dried berries. Start by covering the plant material with cold water, heat it until it boils, and continue to boil it for an hour before straining. Decoction is used for cinnamon and cloves.

Collecting Gels

Gels are found inside the leaves of succulent plants, such as aloe vera. You can simply scrape them out with a knife and then squeeze them through muslin. Gels are used directly on the skin for treating burns, bites, and rashes.

Preparing a Tincture

Because tinctures are generally taken internally, preparing them is not an appropriate classroom activity. You may, however, wish to describe the technique to the students so they that are aware of the general range of extraction processes.

To prepare a tincture, plant material is soaked in alcohol for about two weeks. The alcohol dissolves out the active ingredients and also preserves them. For this reason, tinctures can last for years. Tinctures are often used therapeutically, in which case a few drops are diluted in water. Many types of alcohol are poisonous. For this reason, methylated spirits and other toxic alcohols are avoided in the production of tinctures. A 25 percent solution of ethanol is a safe form of alcohol to use in a teacher demonstration.

Storing Plant Extracts

Aqueous (water-based) extracts of plant material tend to deteriorate quite quickly. A change in the solution's smell will usually indicate that its "use-by date" has been reached. Refrigeration will help, but chilled aqueous extracts still have a limited shelf life. An oil-based extract will keep for much longer, provided that it's well sealed and stored away from bright light, preferably in a dark, glass bottle. (Avoid plastic storage vessels and those with rubber seals because essential oils can degrade or completely dissolve rubber and some plastics.) As with aqueous solutions, refrigeration will lengthen the shelf life of an oil-based extract.

Using Essential Oils as Herbal Remedies

You or the students may wish to extend the focus of the unit beyond perfumes by exploring the topic of aromatherapy and other remedial treatments. By surveying their families or the local community, the students could develop a list of common ailments that can be treated by readily available plant remedies, for example, headaches, indigestion, stress, sunburn, joint aches, insomnia, and bruising. Make the point that, like over-the-counter, pharmacy remedies, herbal extracts are useful for everyday complaints, but they should not replace standard medical consultation and treatment. In particular, stress the fact that common aches and pains are sometimes symptomatic of more serious medical disorders. If such symptoms persist, it is important that the sufferer consult a doctor.

To match active herbal extracts to various ailments, the students could research a variety of sources. "Junk mail" frequently contains health fliers advertising a range of products and describing their contents and applications. Most public libraries stock books on natural home remedies, aromatherapy, and traditional Māori medicine. The

School Library Service has an excellent collection. The Internet is another very useful source of information. To focus the students' research, you could ask them to choose a few common and treatable ailments and then research the herbal remedies that can be used to alleviate them. Alternatively, they could identify a few locally available medicinal herbs and research which ailments they can be used for.

If time is a constraint, this research phase can be bypassed or shortened. Many natural remedy books include a grid that lists ailments and matches them with a wide range of herbal agents.

Once the students have identified a potential user (a specific person who suffers from a minor ailment) and have matched this user with a potentially effective treatment (a plant containing an active ingredient that may be effective against the specific ailment), they need to consider how the active ingredient can be extracted and applied. The common extraction processes have already been noted. Means of application include burning infused oils in an oil burner (aromatherapy), applying them as a massage oil or bath oil, applying water-based extracts as a hot or cold compress, directly applying gels as pure lotions, or using an essential oil as the active ingredient in an ointment, balm, or cream.

The students can then begin collecting the plant material, extracting the active ingredient(s), and preparing the final product, complete with packaging and user instructions about its application and storage. This is a lengthy process if done fully. It may be more manageable to narrow the range of technological activity so that a whole group works on one plant, ailment, and product, for example, infused lavender oil. The group could share the work of considering various ways to deliver the lavender oil to a range of users who have different needs. Each product would require a different style of packaging and instruction according to the target user's situation.

How to Make Ointments and Creams

Ointments are made from waxy materials, such as paraffin, beeswax, and petroleum jelly. They contain no water and form a layer on the skin's surface rather than soaking into it. To make an ointment, combine 25 grams of beeswax with 100 millilitres of infused carrier oil in a Pyrex bowl or a large, clean baked bean tin. (If you use a tin, you avoid having to clean the waxy residue from the container afterwards.) Heat the container in a pot of water until the wax has melted and mixed with the oil. Remove the container from the hot water and stir the mixture well. The ointment will set quite firmly, so pour it into glass containers while it's still warm (but not hot, in case it cracks the glass). To make a softer ointment, decrease the proportion of wax.

Creams tend to be absorbed by the skin because they contain added water and emulsifying agents, such as glycerine. To make a cream, follow the same method as for an ointment but add 25 millilitres of hot water (or hot water infusion) drop by drop to the wax-oil mixture, stirring constantly until the cream thickens and cools. Glycerine, which is available from most supermarkets, is an optional extra. It will make the oil and water-based components more miscible, thereby producing a smoother cream. If you wish to add glycerine, stir a few drops into the cooling mixture.

To make soap balls, pour a cupful of Lux flakes into a Pyrex microwave bowl and mix in about 3 tablespoons of water. (You may need to experiment a little with these measurements.) Add a few drops of essential oil and heat the mixture in a microwave on high for 10-second bursts until a slurry forms that is thick enough to be mixed into balls. Wrap each ball in muslin until it has cooled and reset.

To make a room spray, add about 10 drops of ethanol to about 50 millilitres of a water-based extract. This both preserves the extract and makes it more volatile. Put the mixture into a spray bottle. (Ethanol is a substance that should be used in primary schools only in teacher demonstrations or by students under close adult supervision. Always work with ethanol in a well-ventilated area.)

Technology and Society

The previous activities address the Technological Knowledge and Technological Capability strands. In order to address Technology and Society, the students could explore how essential oils have been used in the past as remedies or in the production of perfumes. The focus could be on Māori culture, other Polynesian cultures, or European, African,

and Chinese traditional remedies. How have the lives of various groups or individuals been changed by the mass-production of perfumes and therapeutic oils? Have social attitudes to alternative therapies changed over the years? For example, up until the mid-twentieth century, the "Rawleighs man" would (and in some areas, still does) travel around with all sorts of purportedly curative products. Although alternative treatments were pursued by only a minority in the middle of last century, there was a tremendous resurgence of interest in them in the 1970s, 80s, and 90s. The students could interview people of various ages to canvas their memories of and attitudes to alternative medications and treatments. Such a survey would be particularly interesting if it included interviews with both orthodox and alternative medical practitioners. It would also be interesting to compare how production techniques have changed as new technologies have been introduced and techniques have been refined.

An exercise in designing and testing packaging and presentation could focus on marketing a product to a specific user group. Such an activity would give the students an opportunity to explore how technological innovations are communicated. It would be useful for the students to visit shops that sell health products in order to look at the range of herbal products available and consider how they are packaged and promoted.

Cross-curricular Links

English: exploring instructional writing by examining the information included on the label of an existing product, such as a shampoo or a herbal tonic; discussing what information the buyer needs in order to use the product safely and effectively and analysing how such information is presented (as well as researching what needs to be communicated by law); considering the features of visual language that catch the eye and attract the consumer in a range of commercial products; debating the relative benefits and disadvantages of orthodox and traditional medicines, perhaps by role-playing various practitioners and members of the public

The Arts: designing labels and packaging to suit a particular product and a particular consumer group, taking into account the different visual impacts of various fonts, text styles, illustrations, colours, and layouts.

"The World of Ferns and Moss" and "Hine-rau-whārangi"

Possible Achievement Objectives

Science

Living World

- 3.1: Distinguish between living things within broad groups on the basis of differences established by investigating external characteristics.
- 3.2: Investigate special features of common animals and plants and describe how these help them to stay alive.
- 3.4: Explain, using information from personal observation and library research, where and how a range of familiar New Zealand plants and animals live.
- 4.1: Investigate and classify closely related living things on the basis of easily observable features.

Developing the Ideas

By reading "Ao Aruhe"me "Hine-rau-whārangi" By reading "Hine Kawakawa", your students will gain an understanding about the following main concepts:

- The characteristics of ferns and mosses
- Aspects of how plants grow
- Māori mind, Māori spirit – relating to science
- Comparisons and relationships between two science systems.

Despite their widespread distribution and abundance in the bush and other New Zealand environments, ferns and mosses are often less obvious than many more highly evolved plants, such as conifers (cone-bearing plants) and angiosperms (flowering plants). For this reason, your students may have basic ideas about ferns and mosses but little detailed knowledge. Mosses and ferns provide an opportunity for students to study contrasting strategies for water transportation in plants. The topic of water transportation leads into a consideration of environmental limitations on organisms.

Background Information
Water Transportation

Mosses have virtually no internal conducting tissues, whereas ferns have phloem vessels for internally conducting nutrients and xylem vessels for conducting water. This key feature affects the range of habitats in which the two types of plant can survive. Mosses have a restricted distribution compared to ferns, which can survive in drier areas because they are able to transport water from their roots to their stems and leaves. (Note, however, that ferns generally prefer damp or humid habitats, such as shady forests.) Ferns can also become much taller because their conducting tissues allow them to grow up and away from the moist surfaces to which mosses are restricted.

(Note that, in some species of moss, rudimentary water conducting cells are present in the stem. Known as hydroids, these cells are similar to the least specialised conducting cells of primitive ferns. In some mosses, the central leaf vein may also conduct water. Thus, in terms of water conduction, the most highly evolved mosses can be thought of as verging on the breakthrough of internal transportation systems.. However, most mosses rely exclusively on the external transportation of water on their stems and leaves, which directly absorb moisture.)

Discussion Points and Activities
A Simple Activity

Having read "Moss" and "The World of Ferns", the students could conduct a simple trial that contrasts the absorbency of moss and fern leaves. Collect a clump of moss and leave it to dry in a warm spot for a few days. Then have the students investigate how much water the clump absorbs. Using a measuring cylinder or a plastic pipette, they could slowly drip water onto the centre of the clump until it begins to dribble out from the edges. Having noted the amount of water that's been absorbed, the students could then repeat the activity with a similar-sized bunch of dried fern leaves, which will not absorb the liquid nearly so well. Ask the students whether they recall from the article the information about water conduction in ferns. Explain that mosses lack internal conducting tissue and therefore need to transport water on the outside of the leaves and stems, which absorb the liquid directly. This is why a clump of moss soaks up water so well, holding on to it until enough has been absorbed directly through its leaves.

Features of a Typical Moss Leaf

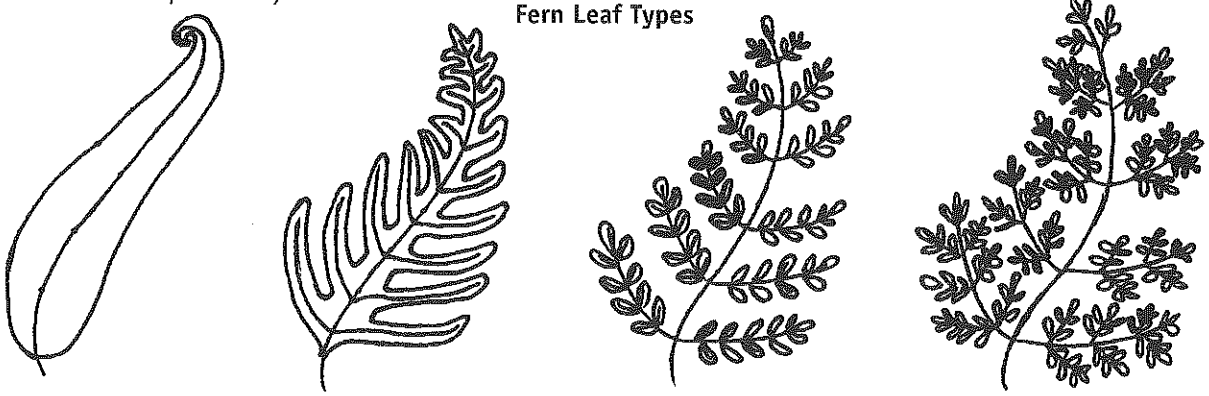
Given that moss leaves are designed to absorb water, ask the students to suggest some possible anatomical adaptations of a typical moss leaf. (Most plant leaves don't absorb water to the same degree as moss leaves. Note, however, that many plants do absorb small amounts of moisture through their leaves, which is why houseplants respond well to a regular misting with a spray bottle.)

At this stage, you should expect only very general ideas, and you may need to prompt the students by asking such questions as "Do you think that typical moss leaves would be large and thick?" (Moss leaves are small and very thin indeed, often only one cell layer thick. This is because all the cells need to be at the surface in order to absorb water from their surroundings.) "Many plants have a waterproof, waxy covering on their leaves called the cuticle. Do you think that moss leaves would have this feature?" (You could hand around some camellia leaves so that the students can feel their waxiness. The cuticle is designed to hold in water, most of which has been absorbed by the roots and then transported upwards through the plant. If mosses had such a cuticle, they wouldn't be able to absorb moisture easily from their surroundings.) "Do you think that moss leaves would be spaced wide apart?" (Moss leaves are densely packed together in clumps, which hold water like a sponge. If the leaves were widely spaced, there would be no sponge-like effect, and the thin, cuticle-free leaves would rapidly lose water as air currents passed over them.)

Features of a Typical Fern Frond

There is significant variation in the leaf shape of different fern species, and these characteristics are an important means of classifying and identifying them. A fern frond consists of a stipe (stalk), which holds the frond's lamina (blade) in position. The part of the stipe that runs up through and supports the lamina is called the rachis (midrib). The frond may be undivided, for example, in the bird's nest fern. More commonly, the lamina is divided into a number of leaflets known as pinnae (singular: pinna), each of which is supported by a central vein. The pinnae may arise on either side of the rachis in pairs or they may alternate on either side. The pinnae themselves may be further divided into secondary pinnae, which in some species are divided into tertiary pinnae. (These are also known as pinnules.)

Fern Leaf Types



A simple frond **A pinnate frond** **A bipinnate frond** **A tripinnate frond**

The students could look through books to find an image of a New Zealand fern species that exemplifies each leaf type. They could also collect, preserve, and display a similar range of leaf samples from living ferns – if there are private or public gardens nearby and they are able to gain permission to collect samples.

Further Activities

A Field Trip

On page 108 of *Making Better Sense of the Living World* is an activity that's designed to focus students' minds on moss and fern habitats in relation to water. If you are near an area of bush, the students could conduct a survey to identify the area(s) in which they find the greatest abundance of mosses and ferns in this habitat. The should then see whether they can discern patterns in this distribution, especially in terms of light levels and water availability. For example, they will probably conclude that while both mosses and ferns prefer damp conditions, ferns are often able to colonise dryer environments than mosses are. The students might also notice that mosses grow more prolifically on the south side of tree trunks, which are exposed to less direct sunlight and are therefore slightly moister.

Even in the school environment, the students will probably be able to conduct a simple survey. (Of course, the distribution of ferns in an artificially planted habitat will depend on the ideas of the gardener – but in most cases, he or she will have chosen shady, moist spots for them.) Note that mosses can survive in habitats where water is periodically absent – as long as the dryness is not prolonged. Thus, mosses can be found even on rock, concrete, and brick surfaces in gardens and courtyards that are exposed to direct sunlight for short periods. Such mosses dry out and become brown in the absence of water but quickly rehydrate and turn green again when water is available once more. It is this phenomenon that the students will observe if they water a dried-out clump of seemingly dead moss.
The students could also observe or research the sorts of insects and other invertebrates that live in and around moss colonies.

Background Information

The Moss Economy

New Zealand Geographic, Number 7, July-September 1990 includes an interesting article about the sphagnum moss industry on the West Coast of the South Island. Once highly valued for its antiseptic qualities, sphagnum moss now has another economic spin-off as a cultivation medium for orchids. This article explains how West Coasters harvest and prepare sphagnum moss for the lucrative export market.

The Evolution of Plants

At higher primary school levels, you may wish to have the students analyse the plant world in terms of evolutionary relationships, which will place the development of conducting tissue within the broader perspective of the plant world as a whole. The students could research the general history of plant evolution for themselves, or you could give them the information if you would prefer them to focus on activities other than book research. A key point is that mosses and ferns sit on either side of a major boundary in plant classification: that between the non-vascular plants, which lack internal conducting tissues, and the vascular plants, which have specialised tissues for transporting fluids.

Algae

The fossil record indicates that algae were the first plants. These small, early species developed about 550 million years ago in the mineral-rich oceans of the time. Today's algae range from microscopic, unicellular plankton and slimes to giant seaweeds. Microscopic algae (phytoplankton) are hugely prolific and form the basis of many marine and fresh water food chains. For this reason, phytoplankton are sometimes referred to as the great meadow of the sea. Although most algae are aquatic, some species are found in damp terrestrial environments, including soils, wooden surfaces, and rocks. Certain species are even adapted to live in the fur of sloths.

Algae lack true roots, stems, and leaves. Because they are usually immersed in water, they generally have no need

for internal conducting or supporting tissues. Many seaweeds are attached to a stable surface by a root-like structure, called a holdfast, that connects to elongated fronds that wave about in the water. Like all plants, algae are photosynthetic, but their fronds and other structures are not differentiated into the wide variety of tissue types that characterise higher plants. However, the stalks of some species of kelp contain a central strand whose cells resemble the conducting elements of vascular plants.

Algae reproduce asexually by dividing, fragmenting, budding, or producing spores. They reproduce sexually by releasing male and female gametes (eggs and sperm), which fuse and develop into a new plant. Most species of algae reproduce both asexually and sexually. In general, asexual reproduction is an effective way of rapidly colonising an environment in times of plenty. Sexual reproduction in some species is very rare, occurring only in times of hardship, in which the zygote (fused egg and sperm) lies dormant until conditions improve. There are, however, no hard and fast rules for this, and the exact balance between various strategies of sexual and asexual reproduction differs from species to species.

Spore-bearing Plants

Plants first colonised the land about 400 million years ago. The first terrestrial plants to appear were the mosses, liverworts, and ferns. These plants all reproduce both sexually by producing gametes and asexually by producing spores. Mosses and liverworts combine these two stages in a single plant, whereas the fern life history is characterised by separate spore-producing and gamete-producing generations. For more detailed information about moss and fern reproduction, see the separate notes for "How Ferns Multiply".

As discussed, ferns and their close relatives, including horsetails and clubmosses, represent a great evolutionary advance in that they have stems, roots, and vascular tissue, which allow them to grow very large compared to mosses. Ancient horsetails and clubmosses were very dominant plants in the time of the dinosaurs, but today they are far less common. Ferns, however, remain abundant in a wide range of habitats.

Seed-bearing Plants: Gymnosperms and Angiosperms

Seed-bearing plants appeared approximately 300 million years ago, and they dominate the plant world of today. There are two main types of seed-bearing plant: gymnosperms, whose seeds develop within cones, and angiosperms, whose seeds are fertilised within flowers and often mature within fruits. The largest group of gymnosperms are the conifers. The more than 500 species include pines, firs, and cedars. Many of New Zealand's indigenous trees are conifers, including kauri and rimu. Conifers are fast growing and usually have a single tall, straight trunk. Their softwood timber is much sought after. Conifer leaves are thick, waxy, and tough-skinned. They fall off year round, and so the tree is never without leaves. For this reason, they are called evergreens. Conifers grow well in cold, windy, and dry conditions, which are too harsh for many angiosperms. A massive tract of coniferous forest, known as the taiga, extends through Northern Europe, Russia, and North America.

Although angiosperms arise in the fossil record only 150 million years ago, they now comprise about 80 percent of plant species. Angiosperm reproductive organs are housed within flowers, most of which contain both male and female parts (although some species have separate male and female flowers). Each male flower part is composed of a stalk-like stamen, on top of which is a pollen-producing anther. A female flower part is made up of a stigma, which is connected to the ovary by a stalk-like style. Fertilisation occurs when pollen grains make contact with a stigma and genetic material from the pollen makes its way down through the style to the ovary. Within the ovary, male genetic material from the pollen fuses with the female genetic material in each ovule to form a zygote that develops into a seed. For background information about sexual reproduction in angiosperms and related student activities, see Making New Plants, book 26 in the Ministry of Education's Building Science Concepts series (Learning Media, 2002). See also pages 81 to 88 of the Ministry of Education's Making Better Sense of the Living World (Learning Media, 2001).

Similarities and Differences

Aspects of the Māori mind, Māori spirit in science. Making comparisons of the two science systems to see the

connection of Māori science with mainstream science. The objective of "Hine-rau-whārangi", is to help the teacher deliver teaching aspects relating to how plants grow based on Māori belief. It is also intended to encourage a 'wide view' of the science world through 'Māori eyes'.

Hine-rau-whārangi represents and ensures the growth and development of pants, as well as human growth and development. Hine-rau-whārangi is a daughter of Tāne and Hine Tītama. It is said that, when Hine Tītama left Tāne, she disappeared to the underground, subsequently leaving Hine-rau-whārangi to tend to the responsibilities of fertilization and to assist with women. Discuss and deliberate over the following words and concepts:

Ko ngā pū
Kua ruia te kākano ki raro i te whenua, ki roto i te whare tangata.

Ko ngā weu
Nā te kukune, ko te pupuke, ā, e whāngaia mai e te whenua.

Ko ngā more
Kua tino puta mai te akaaka ki te whenua, ā, kua kaha tipu ināianei.

Ko ngā rito
Kua puta te rea ki te whaiao, ki te ao mārama, Tīhe Mauri Ora!

Ko ngā taketake
Ka kaha te tipu o te tinana i runga i te whenua, ā, ka pakari tōna hanga.

Ko ngā manga
Ka pakari ake ngā peka me ngā pakiaka, ngā ringaringa me ngā waewae.

Ko ngā pūkenga
He mārama te kite atu i ngā oritenga, engari he mārama hoki te kite atu kei tēnā, kei tēnā ōna ake āhuatanga, pūmanawa, rerekētanga hoki.

Ko ngā wānanga
Ko te tikanga o tēnei, ko te kimi māramatanga mā te noho tahi, mā te hui tahi, mā te wānanga tahi i ngā mea katoa ka pā mai ki a tātau.

Ko ngā taura
I kōnei ka kitea ngå hononga, ngā tuituinga, me ngā herenga e whakahonohono nei i a tātau katoa ki te tangata, ki te kararehe, ki te ika, ki te manu, ki te rākau, ki te tipu, ki ngā koiora katoa o te ao.

Ko ngā tauira
Nā, titiro ana tātau ki ēnei kōrero, mārama ana te kite atu he tauira tēnei. Koinei te tauira mō te tipunga o te otaota me te tangata, me kī, o ngā koiora katoa.

Cross-curricular Links

English: as a follow-up to field trip research, writing scientific reports about moss and fern features and the way in which these features affect the distribution of various species (You could make such an exercise relatively unstructured, letting the students organise the information in any format that clearly communicates what happened. Alternatively, you could focus the students' minds on the conventions of scientific report writing by asking them to format their reports into sections that convey background information relating to the specific focus question, a description of how the field survey was carried out, a description of the results, which may include tables and diagrams, and a discussion of the conclusions that can be drawn from the field survey.)

The Arts: designing and constructing a museum-type display area in the classroom dedicated to New Zealand ferns and mosses, the specific features and design of which will depend on the theme chosen and the types of material to be displayed (Signage, display cases, and informational labelling will be important aspects of the design if a traditional museum approach is adopted, but the students may wish to explore alternative presentation strategies in which selected objects and images convey ideas in a less structured manner.)

"Grow your own Ferns" How Ferns Multiply

Possible Achievement Objectives

Science

Living World

- 2.3: Investigate and understand the changes that take place in animals and plants during their life cycles.
- 3.1: Distinguish between living things within broad groups on the basis of differences established by investigating external characteristics.
- 4.2: Investigate and describe special features of animals or plants which help survival into the next generation.

Developing the Ideas

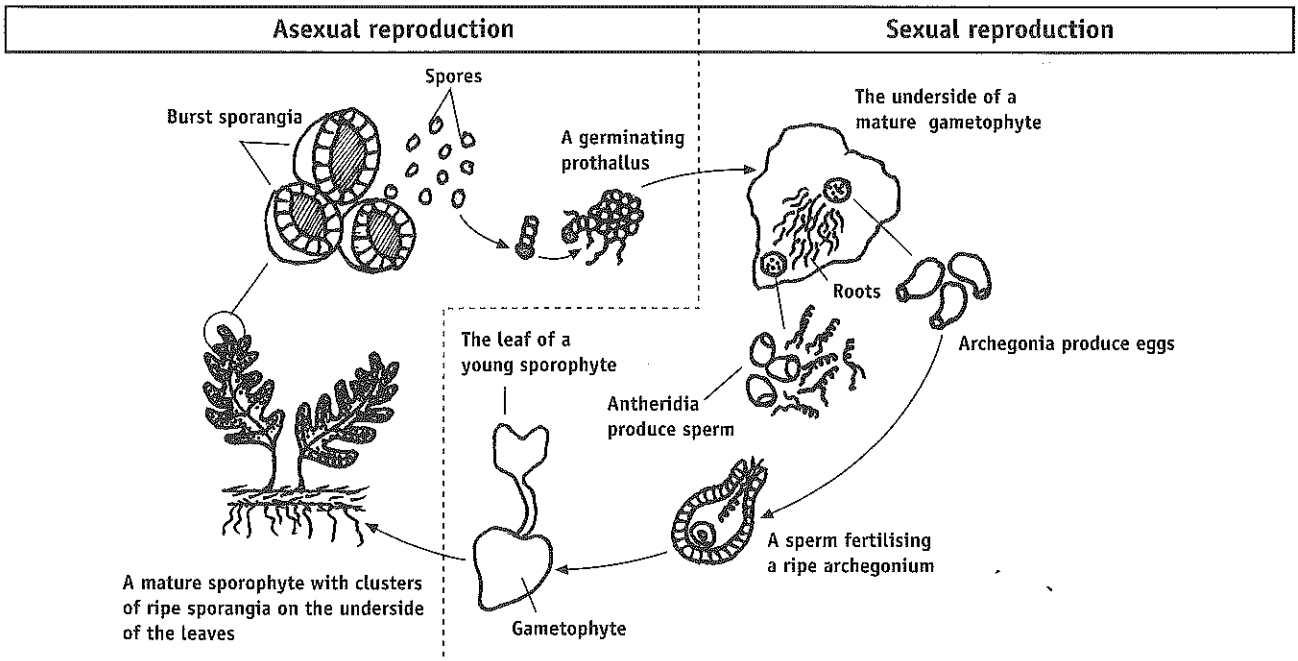
Sexual and Asexual Reproduction

There are two types of reproduction in the plant world: sexual and asexual. When your students grow ferns from spores, they are exploring both phenomena – although, because the sexual phase in fern reproduction is very inconspicuous, they might not realise that it has occurred inside their terrariums. Having read through the activity and set up their small fern-growing terrarium, the students should be allowed time to research the fern life history in more detail. Once they understand sexual and asexual reproduction in ferns, they can explore the two-phase life history of mosses. The moss life history differs from the fern life history in that the more conspicuous element in the fern life history is the sporophyte (the plant that produces spores); whereas the more conspicuous element in the moss life history is the gametophyte (the plant that produces gametes – eggs and sperm).

For more background information about and activities that explore sexual and asexual reproduction in plants, see pages 80 to 89 of the Ministry of Education's *Making Better Sense of the Living World* (Learning Media, 2001).

Further Activities

The Fern Life History

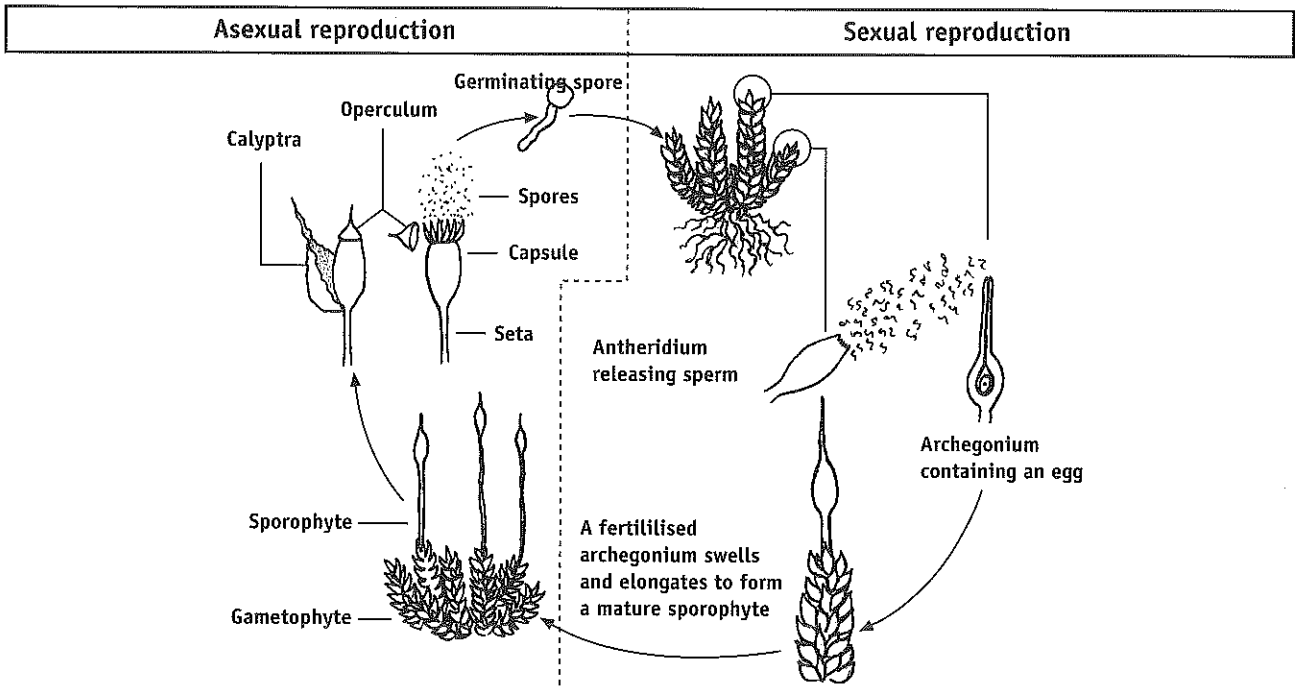


Because the germination and growth of new plants from spores is slow in ferns, there will be plenty of time for the students to research the fern life history while they wait for things to happen in their terrariums. Spores are asexual fruiting bodies whose genetic material is derived from that of a single parent plant – the sporophyte. In other words, in spore production, there is no combining of genetic material from two parent plants. If a spore

lands in a place where the conditions are favourable, it will germinate and grow into a prothallus – the gametophyte. A prothallus resembles a small lichen or liverwort. The prothallus is green and photosynthetic. The male and female sexual reproductive organs develop on the underside of the prothallus. These consist of cup-shaped archegonia (female), each of which produces an egg, and capsule-like antheridia (male), which rupture to release numerous spiral sperm when there is an adequate supply of water for them to swim through.

If a sperm manages to swim to a ripe archegonium, it will usually fertilise the egg within. This is the sexual reproductive phase. The resulting embryo grows into an adult sporophyte. All being well, it will eventually reach sexual maturity and develop sporangia on the underside of its leaves.

The Moss Life History



In the moss life history, the conspicuous plant is the gametophyte. When the gametophyte is sexually mature, archegonia and antheridia develop. In some moss species, the antheridia and archegonia develop on the same plant – these species are termed bisexual. In other species, there are separate male and female plants – these species are termed unisexual.

As with ferns, the antheridia release sperm when conditions are favourable. Sperm are chemically attracted to the ripe archegonia on nearby plants. After fertilisation, a sporophyte grows out of the archegonium and remains attached to the parent plant. The sporophyte of a moss is often clearly visible, though small compared with the gametophyte from which it grows. In general, a sporophyte consists of a long stalk (the seta) at the top of which is a spore-bearing capsule. Once mature, the capsule's sheath (the calyptra) peels off and the capsule's lid (the operculum) flicks open, liberating the asexually produced spores. If a spore lands where the conditions are favourable, it will germinate and develop into a mature gametophyte.

Animal Life Histories

You may wish to broaden the topic of life histories beyond plants and look at animal life histories as well, perhaps with a focus on discrete life stages, such as development within the uterus compared with later development, or with a focus on the different phases in the life histories of animals that undergo partial or complete metamorphosis. See the Ministry of Education's Animal Life Histories, book 4 of the Building Science Concepts series (Learning Media, 2000)

Cross-curricular Links

English: writing reports with illustrated diagrams that explain the life histories of ferns and mosses, possibly focusing on key similarities and differences

"Rata and his Waka" How High Is That Tree?

Possible Achievement Objectives

Mathematics

Geometry

- Draw and interpret simple scale maps (Exploring shape and space, level 3).
- Enlarge, on grid paper, simple shapes to a specified scale (Exploring symmetry and transformations, level 3).
- Construct triangles and circles, using appropriate drawing instruments (Exploring shape and space, level 4).
- Apply the symmetries of regular polygons (Exploring symmetry and transformations, level 4).
- Enlarge and reduce a 2-dimensional shape and identify the invariant properties (Exploring symmetry and transformations, level 4).

Measurement

- Perform measuring tasks, using a range of units and scales (Estimating and measuring, level 3).
- Carry out measuring tasks involving reading scales to the nearest gradation (Estimating and measuring, level 4).

Algebra

- Find and justify a word formula which represents a given practical situation (Exploring equations and expressions, level 4).

Developing the Ideas

Similar Triangles

In the extension activity ("An Extra Challenge"), it is suggested that the students could use the mathematics of ratios and scaling to find the height of a tree. The key here is the concept of "similar triangles", which have identical angles but sides of differing lengths. Similar triangles are in fact the same triangle drawn to a different scale. Before the students approach the problem, you could lead a discussion on the use of similar triangles in this context. Have the students look carefully at the illustration in the students' book. They will be able to see that, from this view, the stick and the tree can be thought of as representing the same side of two triangles. Except for the lengths of their sides, these triangles are identical. (In other words, they are similar triangles.)

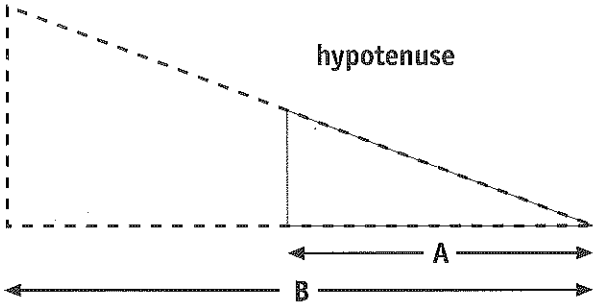
Now have the students look at the second diagram. By moving the stick to a horizontal position and having a second person pace from the tree to the point at which they appear to be standing at the end of the stick, you are essentially laying flat the two triangles from the first diagram. (These triangles are identical to those of the upright version.) For this reason, by measuring the distance between the base of the tree and the second person, you are, in effect, measuring the height of the tree (without having to climb it).

If your students are motivated and confident in geometry, then you could let them take the lead in working out the extension challenge for themselves. If, however, your students are less confident, then you may wish to explain the ideas and techniques more overtly.

Exploring Scaling

You could begin by introducing some general ideas about triangles, measurement, and scaling. Use the following diagram of similar triangles to introduce the term "scale factor". (This is a good example to start with because length **A** is exactly half the size of length **B**, which will make the calculations quite simple.) Ask the students to identify the main similarity and the main difference between the two triangles. The similarity is that the

angles are all the same. The difference is that the lengths of the sides are different. Thus, the two triangles are identical except for their size. Now ask the students to measure and describe the relative sizes of lines **A** and **B**. They should come up with such statements as "**A** is half as long as **B**" or "**B** is twice as long as **A**."



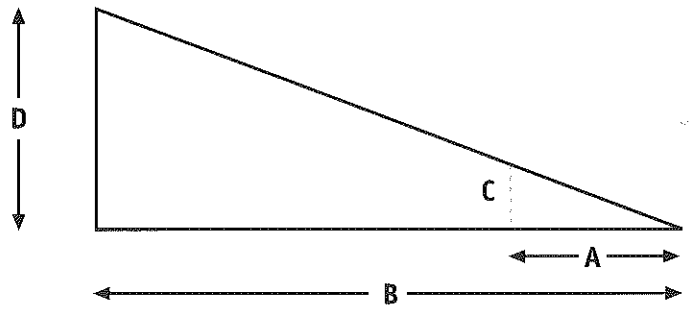
If you knew the length of **A** but not **B**, you could work out the length of B by applying the following rule:

Length **A** x scale factor = length **B**

Some students may need to be shown how to find the scale factor, whereas others will be able to explore the question and derive the solution themselves.

The scale factor is $\frac{\text{length } \mathbf{B}}{\text{length } \mathbf{A}}$

In this case, the scale factor is two (and so **A** x 2 = **B**). Once the rule has been established, the students should use the scale factor to infer the length of the other sides. First give them the length of the upright side of the shaded triangle and ask them to work out the length of this side on the unshaded triangle without measuring it. Then reverse the procedure by giving them the length of the hypotenuse of the unshaded triangle and ask them to work out the length of the hypotenuse on the shaded one. (In this reversed case, the students will have to divide by the scale factor.) Having explored this simple problem, the students can progress to consider the question of working out the height of a tree by applying the same principles.



A x scale factor = **B** (the distance from the tree)
so **C** x scale factor = **D** (the height of the tree)

In a practical sense, **C** represents a stick held upright at ground level or poked into the ground. Measurement **A** represents the distance between a person's eye and the stick when the top of the stick is visually aligned with the top of the tree. Once again, you may wish to reiterate the key point that the technique works because the two triangles are identical in all respects except for the lengths of their sides. This means that the principles of scaling can be used to work out the unknown measurement. The scale factor can be worked out in the same way as for the previous example: scale factor = **B** ÷ **A**.

The students could then recontextualise the problem and the solution by looking for similar measuring situations around the school and home. They could then design a poster to illustrate these.

Sources of Inaccuracy

Discuss how the students could perform such measurements on their own. Ask them to think about possible sources of inaccuracy. One of the main problems with this technique would be the fact that a person would never be able to line up their eye exactly at ground level – unless they dug a small trench! The students could design a practical test with objects of known height in order to work out how significant this sort of inaccuracy is in reality.

For a method that uses a mirror to get around this source of error, see page 113 of *Mathematics in the New Zealand Curriculum*.

Further Activities

Using Shadows to Find the Height of a Tree

Another way of working out an unknown measurement, this time by using shadows, is also outlined in the Ministry of Education's Figure It Out series. See *Measurement*, Levels 3–4 (Learning Media, 2001). On page 1, the activity Shady Shadows uses exactly the same principle of finding and applying a scale factor. Specifically, the students could measure the length of the tree's shadow and, at the same time of day, measure the length of a shadow cast by a metre ruler. They could then compare the ruler's length to the shadow's length in order to derive the scale factor and then use this factor to infer the tree's height from its shadow length. Once again, ask the students to consider possible sources of error. In this procedure, the ruler must be held absolutely vertical as even a small divergence from the perpendicular could significantly affect the accuracy. It would therefore be advisable to use a plumb line (that is, a string with a sinker attached).

Exploring Enlargement in General

The students' book activity could be used to introduce enlargement in general. The variety of shapes that the students look at could be extended from triangles to include quadrilaterals, pentagons, hexagons, and even simple diagrams of objects.

The Figure It Out series includes many activities that address scaling and enlargement in a number of contexts that would involve the students using grids for enlarging or reducing images or designing and using scaled maps. For classroom activities and explanatory material, see the students' books and teachers' notes for *Geometry*, Level 3 and *Geometry*, Levels 3–4 (Learning Media, 2000 and 2001 respectively).

It would be worthwhile for the students to compile a list of the properties of shapes and objects that are changed by enlargement and those that are not. One approach would be to get the students to draw up a table that includes a row for enlarged objects and a row for reduced objects. The columns to the right outline the following attributes: length, area, volume, angle size, shape, and orientation. The students could draw a tick or a cross in each field, depending on whether each attribute changes.

	Length	Area (2-D objects)	Volume (3-D objects)	Angle size	Orientation	Shape
Object enlarged						
Object reduced						

New terms that could be introduced include "object" and "image" to describe the original and the enlargement or reduction respectively.

Enlarging Area

An important point to note is that when enlarging shapes by a scale factor, the lengths of the sides should be multiplied by this scale factor, but the volume increases by the (scale factor)2. For example, a 1.5-centimetre square has a volume 2.25 cm2. If you increased the sides of a 1.5-centimetre cube by a scale factor of 3, each side becomes 4.5 centimetres long. The area increases by the scale factor squared (3 X 3 = 9). Thus, 2.252 X 9 = 20.252. Working with such calculations could be an extension activity for more able students.

Cross-curricular Links

The Arts: creating attractive fabric or wall frieze designs that involve the repeated enlargement and/or reduction of patterns (and possibly their rotation as well) and incorporating these motifs into a wall display that communicates ideas about geometric transformations; designing posters that portray techniques for estimating the height of a tree, using minimal text and communicating the ideas by way of the visual imagery instead

English: writing a letter to a friend explaining one technique for estimating the height of a tree, including clear diagrams that will help the reader to understand this technique

Beetle

Possible Achievement Objectives

Mathematics
Statistics

- Use a systematic approach to count a set of possible outcomes (Exploring Probability, level 3)
- Predict the likelihood of outcomes on the basis of a set of observations (Exploring Probability, level 3)
- Estimate the relative frequencies of events and mark them on a scale (Exploring Probability, level 4)
- Find all possible outcomes for a sequence of events, using tree diagrams (Exploring Probability, level 4)

Developing the Ideas

At appropriate points, you may wish to introduce probability and statistics activities from the Ministry of Education's mathematics exemplar project. These can be accessed on the TKI website through either the assessment kete or the mathematics community. The direct address of the mathematics exemplar page is www.tki.org.nz/r/assessment/exemplars/maths/index_e.php

After having read the story, it would be a good idea for the students to play a couple of rounds of Beetle themselves. They could then go on to explore the concept of probability. If the class has not spent much time on probability before, you may need to help them to understand what probability is and how it can be described in terms of fractions.

Focus the students' attention on the illustration that shows which body parts each player had when Winitana won the first round. Ask the students to imagine that the game was continuing and calculate Ngāpera's chances of throwing a number that would get her the next part she needs, which was only a leg by this stage. To get a leg, she needed to throw a 1. Her chances of a favourable outcome were therefore 1 in 6. Ask whether anyone expressed this probability as a fraction. If no one did, ask the class to think about how they might express the probability in this way (1/6).

Now ask the students whether they can come up with a general rule for finding or describing probability:

$$\text{The probability of an event} = \frac{\text{the number of favourable outcomes}}{\text{the total number of possible outcomes}}$$

Then ask the students to use fractions to express the likelihood that each of the other players will have a successful outcome from their next throw of the dice. For example, Te Kōtuku needs a leg, wing, or feeler, for which he needs a 1, 3, or 4. Because there are three desirable numbers for Te Kōtuku, his chances of a favourable outcome from each throw are 3/6, which may be simplified to 1/2. (Both the numerator [top number] and the denominator [bottom number] are divisible by 3.)

Ask the students to explain in their own words how Te Kōtuku concluded that "It always seems hardest to throw what you want at the beginning and the end of a game" and that "Things speed up in the middle of the game." You could ask the students to write their explanations in the way that Te Kōtuku might have described things to his father. The following example includes the main points that students need to understand.

"There are 6 numbers on a dice. At the beginning, you have to throw a 6 in order to get the beetle's body. That means you've only got 1 chance in 6 (or 1/6) of throwing what you want. After that, you need the head before you can get the feelers, eyes, or mouth – but you're allowed to get the legs as well. So that gives you 2 chances in 6 (2/6 or 1/3).

"Then, once you've got the head, your chances of getting a number that you want increase to 4 in 6 (4/6 or 2/3) because you can use a 4, 3, 2, or 1. So, in the middle of the game, things can move quite quickly.

"But after that, your chances start going down again. If you throw a 2 and get the mouth, then you only need a 4, 3, or 1. So your chances go down to 3 in 6 (3/6 or 1/2). And because you have to get 6 legs, you're often left needing 1s at the end, so you're back to 1 chance in 6, like you were at the beginning."

Once the students have mastered the basic ideas that underpin probability calculations, return to the illustration. Challenge the students to calculate the probability of a successful outcome for Ngāpera at that stage of the game if she were to throw two dice simultaneously. (The answer comes to 11/36, which the students will arrive at by counting the total number of possible combinations from throwing two dice [36] and then totalling the number of these combinations that are desirable [11]. Te Kōtuku's probability of success is 27/36, which may be simplified to 3/4.)

Extrapolating the Ideas to a Different Context

A way of extending these ideas into a different context would be to explore the probability that an individual in the class will have certain features. Ask the students to draw up a table of common features and count the number of students that exhibit each one. An example is shown below.

Feature	Number of Students with this Feature
Having blue eyes	10
Being a girl	15
Being left-handed	7
Not being born in NZ	4

This activity gives the students an opportunity to learn more about each other as they walk around the room asking questions and collecting data.

Having collected their data, the students should work out the probability of a randomly chosen classmate being in each category. (From the previous activity, they should realise that the probabilities can be expressed as fractions.) The number of students fulfilling the criteria is the numerator, and the total number of students in the class is the denominator.

Feature	Number of Students with this Feature	Probability of Having this Feature
Having blue eyes	10	$\frac{10}{30}$
Being a girl	15	$\frac{15}{30}$
Being left-handed	7	$\frac{7}{30}$
Not being born in NZ	4	$\frac{4}{30}$

If appropriate, encourage the students to simplify the fractions. To relate this activity back to the general rule for expressing probability, you could write the following formula on the whiteboard:

$$\text{The probability of being a girl in Room 6} = \frac{\text{the no. of girls in Room 6}}{\text{the no. of students in Room 6}}$$

$$= \frac{15}{27}$$

It's important to note that such results are only a sample. You could lead a discussion about whether these probabilities would apply to other classes in the school or to other schools in town – if not, why not? Ask the students to consider what might be the results in different schools, and a discussion about methods of taking random samples could follow.

Further Activities

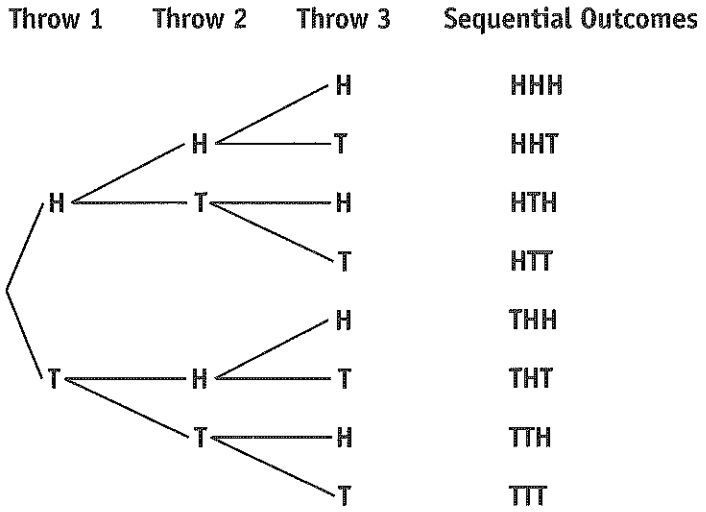
You could use a deck of cards to build further understanding about probability. Discuss the probability of randomly drawing a red card, a Heart, or an Ace of Diamonds from a splayed deck. The students could then test the probabilities for themselves.

For example, with the jokers removed, the chance of getting a red card is 1/2. This means that for every two cards picked at random, one should be a red card. The probability of getting a Heart is 1/4. This means that if four cards are dealt, one of them is likely to be a Heart. Again, a table with the various events and the probability of their outcomes may be a useful tool.

Ask the students to make other predictions and then use a deck of cards to test whether the probability holds true in actuality. They could examine this in another simple context by getting into pairs and tossing a coin 100 times, recording the numbers of heads and tails and then reporting their findings back to the class. They will probably find that the actual events are fairly close to the predicted outcomes, although this may not necessarily be the case.

An important point to make is that probability is not cumulative. Each event is discrete and in no way influenced by preceding outcomes. For example, even if you had thrown a hundred heads in a row, the possibility of throwing a tail next is no greater than 1/2.

The students could also explore probability by way of tree diagrams. For example, they could display the possible outcomes when a coin is tossed three times.



The students could then see that the probability of throwing three heads is 1/8 and the probability of throwing a combination that includes two heads is 3/8. As an extension activity, the students could explore methods of multiplying individual probabilities together to get the same answer. For example, the probability of getting a head is 1/2, so the probability of getting three heads is 1/2 x 1/2 x 1/2 = 1/8 (or 0.5 X 0.5 X 0.5 = 0.125).

The same techniques could be employed with six-sided dice, which would tie in with the Beetle context. The students could also draw tree diagrams for dice with different numbers of sides.

Encourage the students to find other situations where tree diagrams can be used to find all the possible outcomes and probabilities.

The class could then look at probability in other games. The students could bring in a variety of board games and explore the various aspects of chance and skill that contribute to a win. In Monopoly, for example, probability is involved when the players throw dice, picking up cards from the Chance and Community Chest piles. Skill is involved when a players consider how much money they have in the bank and assess whether the potential rental returns from various properties make them worthwhile purchases.

A discussion of Lotto could also add to the conceptual development, especially because working out the probability of winning involves the concept of sampling without replacement. This means that when a ball is taken, it is not returned to the barrel and so the total number of possible outcomes is reduced by one each time.

Students could design and make games of their own. Encourage them to have more than one aspect of chance such as throwing a dice, picking up cards, or tossing a coin. The students could pursue the theme of beetles or insects and, instead of using dice, they could make and use spinners.

Cross-curricular Links

The Arts: creating different designs for beetles and incorporating these into games that involve chance, for example, by designing a board game in which the colours, images, and layout reflect the rules and general progress of the game; designing posters that illustrate how probability calculations can be displayed with tree diagrams, giving particular thought to the use of high-impact visual imagery and the economical but effective use of text

He Kupu Taka

a

āhua pū	*special characteristics*
aka	*vine*
akaaka	*rootlet*
anganui	*face directly towards*
ao rauropi	*ecology*
ara toto	*veins*
ara whainga	*veins(plant)*
ārai huaketo	*antiviral*
ārai huakita	*antibacterial*
ārai kōpura whetu	*antifungal*
ariā	*concept*
arotahinga	*case study*
aro wēra	*aloe vera*
aruhe	*fern, generic*
atiati	*drive away*
auau	*frequency*

h

hai	*ace*
hanga	*shape, form*
hangarite	*parallel*
hangawainga toiora	*metamorphosis*
hātaretare	*invertebrates*
hāte	*hearts* (Ngata)
hawahawa	*lichen*
heipūtanga	*chances*
hinu hā	*essential oil*
hinu kawe	*carrier oil*
hoahoa rākau	*tree diagram*
hohoko	*alternate*
hora(hia)	*splayed*
horomata	*absolute, pure*
horotai	*delicacy*
hua	*product, fruit*
huanga	*zygote*
huangō	*asthma*

i

īkura	*menstration*

k

kai honokōiwi	*arthritis*
kakara whakaora	*aromatherapy*
kamamīra	*cammomile*
kāmata	*top of stick*
kamīria	*camellia*
kano	*egg, of plant*
kapoke	*algae*
kāuru	*tree top*
kirihou	*plastic*
kiritaratara	*echnoderm, skin irritation,*
kōhikatanga	*extract, extraction*
kōhua pēhanga	*pressure cooker*
kokai	*phloem*
kōmukumuku	*rub, wipe*
koroī	*gymnosperms*
korotētanga	*expression*
kotai	*xylem*
kouwha	*female plant, or plant part, archegonia*
kukune	*spring, grow, evolve, foetus*
kukuwhā	*evolve*
kūmete	*bowl*

m

mahere whakaaro	*brainstorm*
maka rota	*dice* (Ngata)
maka(ia)	*throw*
manamana	*hen and chicken fern*
māngaro	*mealy*
maramara	*wood chips*
mārehe	*left handed*
maremare	*cough, phlegm*
mata tarapī	*fine mesh*
mātakitaki	*observation*
matapae(tia)	*predict*
matū whakakaha	*active properties*
mātukutuku	*clubmoss*
mōhio tuturu	*certain*
mōkehu	*fern frond*
moko tuari	*dinosaur*
motumotu	*discrete as in data* (Matatiki)
mura hinu	*oil burner*

n

noho taurua	*sit in pairs*

ng

ngerengere	*leprosy*
ngongo	*tube*
ngongoa	*draw out, suck out, results*

o

ōpapa	*minerals*
otinga	*results*

t

tā ōu mahara	*contented*
tahi hoki	*cleanse*
tāhuahua	*food chain*
takawai	*humid*
takoki	*sprained*
takotoranga pae	*vertical*
tango noa	*random selection*
tārahu	*hotplate*
tārei	*shape*
taru kakaramea tawa	*lavender*

tātā	*stems*
tātaritia	*strain*
tauira	*1. design, 2. sample*
teitei	*tall*
tepe	*gel*
tere whakaeto	*volatile*
tiereniamu	*geranium*
tioka	*joker*
tīpako	*sample*
tīra	*deal* (Ngata)
titi kōnehu	*stamen*
toa	*male plant, or plant part, antheridia*
tohu whakapiripiri	*label*
toi	*rhizome*
tōmua	*primitive*
tongako	*eczema*
tope (a)	*chop*
toriwai	*moisture*
toro	*explore*
torotika	*straight*
tūponotanga	*probability*
tutukiwi	*orchid*

r

raupapa	*sequence*
rauropi	*organism*
rea	*spring, grow, multiply, innumerable*
rerenga kētanga rauropi	*biodiversity*
ripanga	*table*
rorotu	*favorable* (Ngata)
ruia	*disperse, sow*

p

papanga tarapī	*muslin cloth*
papī	*ooze*
pāpono	*event*
pata	*spore*
pātiti Airani	*clover*
pea pōturi	*sloth*
piakaaka	*rootlets*
pihipihi	*gametophyte*
pōkaikaha	*confuse*
pouaka whakatupu	*terrarium*
puhui	*compound*
pūkohu	*moss, generic*
pūpata	*sporangia*
pupuke	*well up, rise*
pūranga kāri	*deck of cards*
purea	*cleanse*
pūtake	*base of tree*

u

uhae	*stigma*

w

wai whakaehu	*glycerine*
waimeha	*dilute*
wairongoā	*tonic*
waiwai	*basic, rudimentary*

wh

whā	*flakes*
whaipua	*angiosperm*
whakaehu	*emulsify, emulsion*
whakamauhītia	*collect, gather together*
whakamoamoa	*economical*
whakapiripiri	*poultice*
whakarara	*horizontal*
whakarewa	*solvent*
whakatau tata	*estimate*
whakatōtā	*condense*
whānui	*wide*
whao	*infuse*
whaonga	*infusion*
whārite	*common*
whāroa	*length*
wharowharo	*cough, expectorate*
wīra whāhuri	*spinner*